

JANUARY, 1951

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS
FOUNDED 1903

EAST ENGINEERING

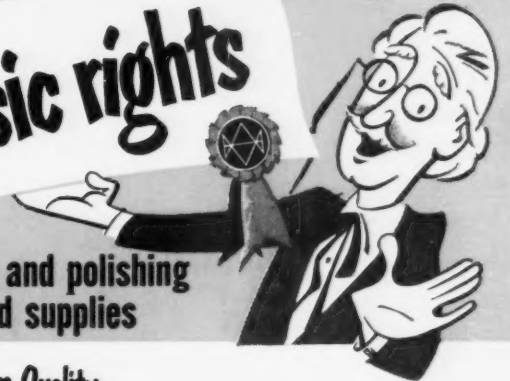
Single Responsibility

...by concentrating your orders with a single source of supply, you eliminate many hours of costly paper work. You pay one bill... have only one supplier who is responsible for your satisfaction... you get your order when and how you want it... eliminate days and maybe weeks of waiting. Whether you want an automatic conveyor or a pair of rubber gloves, H-VW-M can shoulder the whole responsibility for the entire order.

TS
200
MS87

Your basic rights

in buying plating and polishing equipment and supplies



Dependability

... it's your right to expect and get full dependability from your supplier. Only then can you operate with maximum efficiency and economy... be sure your product has the extra salability that comes from consistent uniformity and quality of manufacture. Pioneer in developing equipment and supplies for the plating and polishing industry, H-VW-M has honestly earned a highly regarded reputation for complete dependability under all circumstances.

Uniform Quality

... means that you get full value for your investment. It means that you are doing a better job... are helping your company operate at higher profit levels. The reputation for uniformly high quality H-VW-M has earned is one that has been built up honestly over many years. It is your right to expect it. Through strict control of every manufacturing process H-VW-M works ceaselessly to see that you get uniform quality.

Service

... H-VW-M technical assistance is provided by a highly trained staff of chemical, electrical and mechanical engineers backed by the finest laboratory facilities in the industry. H-VW-M Service does not end with delivery of your order... it is always on tap anytime and anywhere. H-VW-M products are strategically warehoused for prompt delivery... and because inventories are large all orders get immediate attention.

Fair Price

... you have a right to expect to get exactly what you pay for... to receive equipment and supplies that accurately measure up to specifications and represent full value of your investment. H-VW-M equipment and supplies are priced to meet changing market conditions... and H-VW-M always delivers full value. What's equally important, is the fact that because H-VW-M serves as the central source of supply for ALL the needs of the electroplating and polishing industry, you can always be sure that price levels will be equably maintained.



HANSON-VAN WINKLE-MUNNING COMPANY, Matawan, N. J.
Plants at: Matawan, N. J. • Anderson, Indiana • Sales Offices: Anderson
Chicago • Cleveland • Dayton • Detroit • Grand Rapids • Matawan
Milwaukee • New Haven • New York • Philadelphia • Pittsburgh
Rochester • Springfield (Mass.) • Stratford (Conn.) • Utica

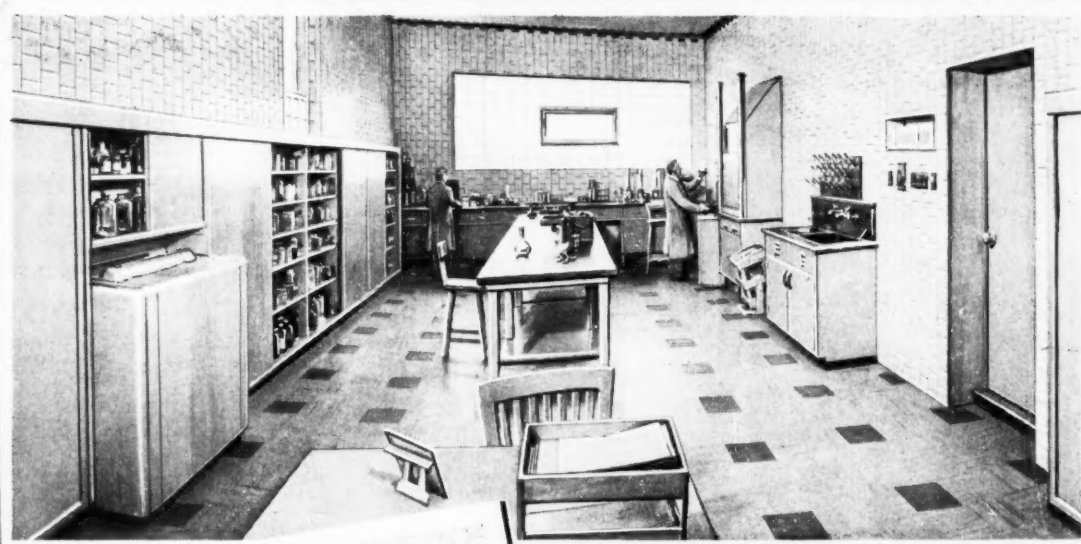
Manufacturers of a complete line of electroplating and polishing equipment and supplies



Review of 1950 Developments
Bright Chromizing • Metal Cleaning
Mobilizing the Job Plating Shops
Complete Contents Page 43

Read & Pass On

TO SERVE YOU BETTER
CLEPO *Expands its Laboratory Facilities*



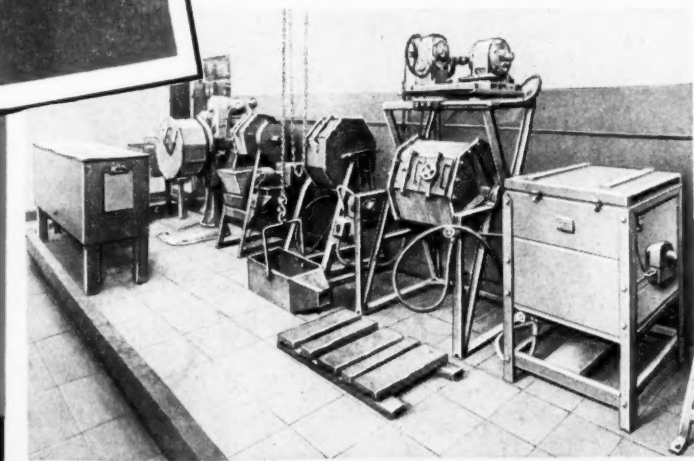
CLEPO RESEARCH AND DEVELOPMENT LABORATORY



CLEPO TESTING AND SEMI
 PRODUCTION LABORATORY

CLEPO BARREL
 TUMBLING PILOT PLANT

FOR YOU A **BOND** OF ECONOMY
 FOR US A **GUMM** OF FRIENDSHIP



FREDEKICK GUMM *Chemical Company Inc.*
 538 FOREST STREET, KEARNY, N. J.

L. H. L.
 PALME
 THOM
 JOAN
 WALTER
 FRED
 JOHN

FINI

II W

Con

Conver
 tered
 second
 187
 14, 19
 under
 STBS
 and C
 Single
 Guide
 418 p
 edition
 order
 Contri
 tinent
 even
 ment.

E K

E Eng
Walls

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

Founded as Metal Industry, January, 1903
by Palmer H. Langdon, 1868-1935

JANUARY, 1951

VOLUME 49 • NUMBER 1

CONTENTS

E Eng
TS
203
11587

Editorial and Business Staff

L. H. LANGDON, *Publisher*
PALMER H. LANGDON, *Assistant Publisher*
THOMAS A. TRUMBOUR, *General Manager*
JOAN T. WIARDA, *Sales Manager*
WALTER A. RAYMOND, *Managing Editor*
FRED A. HERR, *Pacific Coast Editor*
JOHN E. TRUMBOUR, *Equipment & News Editor*

Published Monthly by
FINISHING PUBLICATIONS, INC.

founded 1903 as
Metal Industry Publishing Co., Inc.
11 West 42nd St. New York 18, N. Y.
Telephone: PENnsylvania 6-0226

Pacific Coast Office
Los Angeles 13
424 S. Broadway
MAdison 6-5421

also publishers of
Organic Finishing, monthly

Member



Controlled Circulation
Audit



National Business
Publications



Society of Business Magazine Editors

Copyright 1951 by Finishing Publications, Inc. Entered February 25, 1903, at New York, N. Y., as second class matter under Act of Congress, March 3, 1879. Re-entered as second class matter June 11, 1940, at the post office at New York, N. Y., under the Act of March 3, 1879.

SUBSCRIPTION PRICES: United States, \$4.00 and Canada \$4.00 per year. Other countries \$8.00. Single copies 45c in U. S. and Canada, Foreign 85c. Guidebook-Directory issue, published separately, 48 pages, 5 1/4 x 7 1/4, 1950 revised, 19th annual edition, \$2.50. Please remit by check or money order; cash should be registered.

Contributed articles, communications, etc., on pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement.

News from Washington	45
By George W. Grupp	
Editorial	47
Metal Finishing Progress in 1950	48
By Walter A. Raymond	
Metal Cleaning	55
By D. W. Vance	
Abstracts from the World's Plating Literature	58
Bright Chromizing — The Onera Process	61
By Phillippe Galmiche	
Evaluation of Industrial Wastes in Metal Processing Industries — Part II	65
By David Milne	
Industrial Mobilization of the Job Plating Industry	70
By Will Zinn	
Electrodepositors Technical Society Holds Conference on Electrodeposition in Holland	72
Shop Problems	74
Patents	76
Engineering Data Sheet	77
Recent Developments	78
Business Items	85
Obituaries	92
News from California	92
Associations and Societies	94
Manufacturers' Literature	103
Motor City Plating News	106
Letters to the Editor	108
New Books	109

COMING SOON

Finishing processes for the various alloys of aluminum and magnesium.

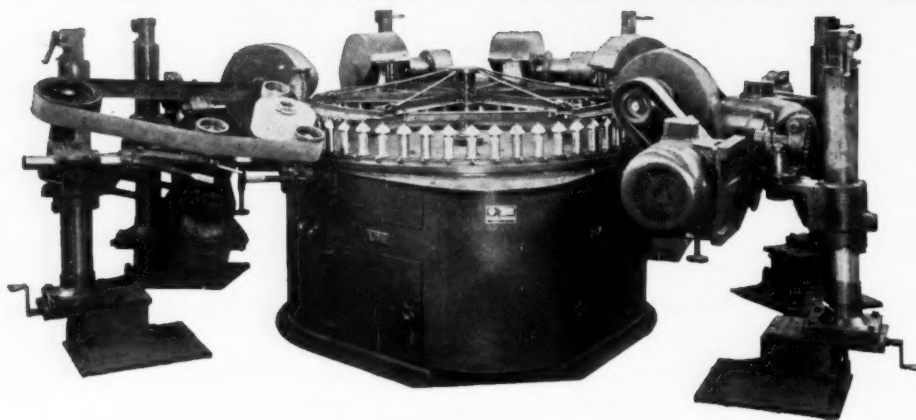
A new conception of plating waste disposal, using an "in line" integrated method of neutralizing and removing toxic materials.

Charts for the rapid calculation of metal plating costs for small parts.

How the Elemental Time Standards can be used to set up a rate system in metal buffing and polishing departments.

ACME *Automatic* POLISHING *and* BUFFING MACHINES

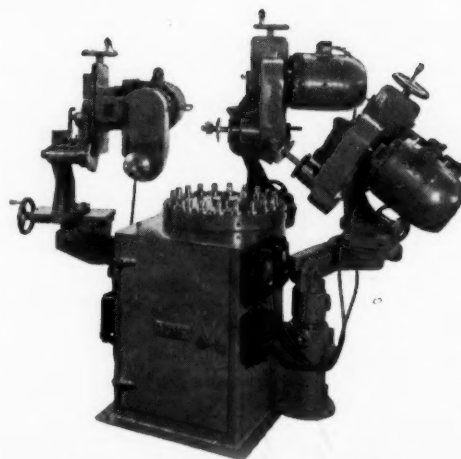
ACME *CONTINUOUS* ROTARIES



... deliver high production with uniform quality finish at low unit cost.

Above: ACME six foot Continuous Rotary Automatic having 50 continuously revolving chuck spindles. One ACME adjustable polishing belt head and five ACME adjustable floating head polishing and buffing lathes are used in this arrangement, built to finish plumbing goods escutcheons.

Right: ACME Type L. C. Continuous Rotary Automatic with 20 spindle continuously revolving table with variable speed control. Three ACME completely adjustable polishing and buffing lathes are used in this arrangement.

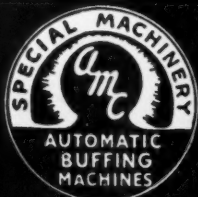


**ROTARY
STRAIGHT LINE
SEMI-AUTOMATIC
AND SPECIAL
Polishing and Buffing
Machinery**

ACME Continuous Type Rotaries are built in table sizes from 20 inches to 10 feet or more in diameter and with a varying number and spacing of work spindles depending on piece being finished. They provide a proved solution to many production finishing problems and have earned wide recognition for their dependability and cost cutting performance.

These machines can be furnished in sizes and arrangements to handle many types of parts with high output and uniformity of finish.

(Catalogs on Request)



ACME Manufacturing Co.
1645 HOWARD ST. DETROIT 16, MICH.
Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY



The WASHINGTON

OBSERVER

News and Views from Official Washington



George W. Grupp

- Drastic controls of metals are not expected until the second quarter of 1951, unless something should happen in world affairs to tighten present controls.
- The easing of controls on aluminum, nickel and zinc for the first three months of 1951 were made to avert serious labor dislocations. Dislocated labor will have its problems until it can fit into work in some other locality or in some industry in its present locale.
- When the defense production program gets going about the second quarter of 1951 the metal finishing industry can look forward to the allocation of electroplating equipment as prevailed during World War II.
- During 1951 there will be an expansion of plant and equipment investments in excess of \$25 billion.
- The National Security Resources Board will not permit industry to write off at the rate of 20 per cent per annum those emergency defense production facilities which have postwar usefulness.
- Industrial dispersion is underway. Industry is beginning to move into small communities as a measure of protection against possible enemy air attack.
- A scrap copper order may be issued to restore the movement of this commodity through regular channels.
- The sharp rise in imported quicksilver prices may result in the opening of closed California mines.
- Taxes will harass the poor and reduce the standard of living of the middle class and well-to-do during the next four or five years. This will be due to the growing demand that we should pay for defense needs as we go rather than finance them on a credit basis. One segment of opinion believes that direct taxes should replace our current myriad of hidden taxes.
- Rent controls - Price and Wage Controls - Ration books for scarce commodities are all definitely in the cards should the international situation become serious enough.



Flexible and More Precise

THAN WITH HARD BURRS



Do cast or stamped parts you are finishing come to you with slivers, fins, rough edges, plugged holes, imperfect corners?

Look into the Lea Burring Method for fast and precise removal of such excess metal and straightening out of edges and surfaces. This method while used to some extent prior to World War II really came into its own when manufacturers were faced with really stiff specifications and close tolerances. The Lea Method helped many a company stay in war-contract business.

Since the war many companies retained the Lea Method of Burring in order to maintain high finishing standards. Now, there is an increasing demand for better preparation of surfaces on which finishing operations are to be performed. Now—as before—Lea is the method being adopted for removing burrs.

Our technical staff will be glad to help you make use of this proved method. Write in detail and, if possible, send us samples of pieces to be deburred for our recommendations.

Burring, Buffing and
Polishing . . . Manu-
facturers and Special-
ists in the Develop-
ment of Production
Methods, Equipment
and Compositions



THE LEA MANUFACTURING CO.
16 Cherry Avenue, Waterbury 20, Conn.
LEA MFG. COMPANY OF CANADA, LTD.
370 Victoria Street, Toronto 2, Canada

*Manufacturers of Lea Compound and Learok, Industry's
Quality Buffing Compounds for over Twenty-Five Years*

The Year Ahead

The coming year is one which will call for "heads up" participation in all fields of industrial activity, and most certainly in the metal finishing field. Our all-too-recent experience during a war mobilization period has taught us to expect shortages of all metals, shortages of skilled labor, controls on prices and wages, priorities, and all the other familiar accoutrements of a nation preparing for war.

The most difficult period will be the transition from civilian to military production. Once fully mobilized, the objectives and the methods for attaining them are clear cut; trying to maintain a very substantial civilian economy concurrently with a partial mobilization is something else again.

Some personal and business hardships are inevitable in the metal finishing industry, as there will be a serious curtailment and dislocation in decorative plating. Short of all-out war, we can expect a cut of 30-40% in new car production, the largest single civilian use for decorative plating. A cut of 35% in aluminum and an inestimable, although certainly as much as 25%, cut in steel availability will curtail the production of home appliances, another major user of decorative plating. To counterbalance this somewhat, more anodizing, chromating, and other processing of aluminum and magnesium alloys can be anticipated, along with an increased call for blackening treatments for ferrous alloys. Electroforming of some critical military parts will also help take up the slack, as will the considerable volume of functional plating such as zinc, cadmium, tin, and hard chrome.

The production of new plating and finishing equipment will be seriously affected not only because of the material shortages, but also because of the lesson learned during World War II to use every available piece of existing equipment by extensive sub-contracting of work. This makes sense, is fair to all, and saves vital materials for other uses.

Perhaps sometime this year the "rainy day" will have arrived when strategic metals can be taken from the government stockpiles, but only for military work and on a strict system of controls.

Job plating shops may be especially hard hit. They depend usually on an overflow of work from manufacturing plants, and it may be quite a while before this condition arrives again.

All in all, the year ahead will not be a "bright" one (pardon the pun) for the plating industry. There will be hardships aplenty, but the plating industry has proven that it can, and will again, make a major contribution to the national welfare.

Whatever the problems in any industry, they are paled into insignificance by the supreme problem of guaranteeing the survival of the American way of life as opposed to the perpetual fear and slavery of communist rule.

H. A. Raymond

Editor

Metal Finishing Progress in 1950

By Walter A. Raymond, *Engineering Editor*



TO say that 1950 was a hectic year in the metal finishing field would be a gross understatement. Starting out the year with an adequate supply of materials and a strong market, there seemed to be no problem other than the unknown quantity of whether the general level of activity would hold up or drop off; there were very few who were willing, at that time, to predict increased activity.

Toward the middle of the year there was a slight tapering off, although the automotive industry kept rocking along under a full head of steam to set new production records. Then came the Korean outbreak, and with it one of the most rapid about faces the plating industry has ever witnessed. A crippling 3 month strike in the major alkali-producing plants, a sudden increase in metal demands for strategic stockpiling by the military establishment, and considerable "scare" buying in excess of immediate needs caused nickel, nickel salts, soda ash, chromic acid, cadmium, and zinc to become almost as extinct as the Dodo bird. Subsequent shortages involving copper, chlorinated solvents, and commercial acids did not help the situation any. As the year ended, everyone was engaged in a mad scramble to get enough materials to keep their finishing lines in full operation, with varying degrees of success. Shortages of steel and aluminum in some instances forced a curtailment, even though finishing materials were available.

In order to control the situation as far as possible many primary suppliers were forced to allocate their materials as best they could under voluntary company-planned systems. Up to this date no government restrictions on plating are in effect.

In one way, the suddenness of the whole shortage situation was a fortunate break, as it did not permit time for extensive hoarding or black-market operations to get established. While there undoubtedly were small amounts of various plating materials being handled in "under the counter" deals, the total is quite significant and will do much more to swell the volume of conversation than it will the volume of finishing being done.

As mentioned above, the automotive industry in 1950 produced at a rate approximately 20% higher than in the previous year. Inasmuch as it is the largest single user of plated products, representing approximately 65% of the total plating activity of the country, the above figure should be fairly representative of the total plating and finishing activity for comparison with previous years. In general it can be

stated that the year was one in which production problems overshadowed the importance of new technical developments.

In the following paragraphs an attempt will be made to summarize the more important economic and technical advances of the past twelve months.

Theoretical

Studies continued on the fundamental nature of such important subjects as stress in deposits, porosity, strength and ductility, current and metal distribution, and throwing power, and much valuable information was uncovered.

The A.E.S. Research project on porosity of deposits showed that very thin (.00015") nickel deposits on highly polished base metals tended to be more permeable (porous) than the same deposit on crystalline (etched) surfaces. This tendency decreased as the deposit was made thicker (.0003" of nickel).¹ Further information on the relation of porosity, either original porosity or porosity caused by chemical solution ["depth corrosion"] of the deposit, to the corrosion rate of nickel deposits is given, and confirmation is made of the fact that organic-brightened nickel deposits are more permeable than regular dull nickel deposits of equal thickness.² A new concept of "depth" corrosion versus initial porosity as a factor in the corrosion resistance of deposits is also brought out. *Evans and Shome*³ investigated the porosity of nickel coatings produced in a commercial manner and concluded that the surface contour had more effect than hydrogen bubbles or defects on the base metal surface.

A new research project on current and metal distribution in electrodeposition got under way,⁴ but up to the present time had only time to complete a comprehensive review of the literature in this field. That there is much need for fundamental knowledge in throwing power is evident from a recent meeting,⁵ at which the undercoat metal, surface condition of the base metal, degree of cold working of the base metal, in addition to the shape of the part, were all claimed to be effective in altering throwing power of commercial plating baths.

*Reinhard*⁶ studied the "microthrowing power" of commercial baths, finding a number of factors to be effective in altering this property. The most important was the fact that acid copper baths had much better ability to deposit into minute crevices than did cyanide copper baths.

Plating at high temperatures, one of the ever-intriguing subjects in the electrodeposition field, was studied by *Brenner and Senderoff*⁷ for chromium, copper, molybdenum, nickel, titanium, tungsten, vanadium, and zirconium at temperatures up to 300°C. In general, no improvement due to the high temperature

was found, although anode corrosion seemed to improve.

One of the more interesting trends in electrochemical research is the use of radioactive materials to study basic phenomena. A tracer method was developed by *Kronsbein*⁸ for determining current and metal distribution, while *Harris* and *Camp*⁹ used this technique for evaluating metal cleaners. This latter study proved the superiority of the technique for metal cleaning studies, as it is more sensitive and reproducible than the methods heretofore in use, in addition to eliminating the human factor in the final evaluation.

Blast Cleaning — Descaling — Deburring

There was a continuation in the trend to use blast cleaning methods in place of acid pickling baths where possible, the chief reason being the alleviation of a waste treatment problem, especially in the smaller plants. The use of soft grits for blast cleaning and de-burring finished machined parts was more widely practised,¹⁰ as was the use of liquid-media blast cleaning.

The sodium hydride descaling process, which is rapidly becoming a standard method of stainless steel preparation, was placed on a royalty-free basis by one of the proprietors.¹¹

An extremely interesting and novel method for de-burring parts, using ultrasonic vibrations, was the subject of a British patent.¹² In this method the parts are caused to rub against each other, or against de-burring media, by the high frequency vibrations induced by an ultrasonic generator. This could develop into a very promising finishing method.

Polishing and Buffing

The continued development of more diversified automatic machines for polishing and buffing made it possible to extend the range of applications for this type of equipment, so that many shops having relatively short runs of a given part could economically consider using it. The trend of the past few years toward the use of abrasive coated belts to replace headed wheels, for reasons of economy and uniformity, continued. Another technique which is showing rapid advancement is the pre-finishing, or "flat-polishing" of sheet stock prior to forming operations. In addition to reducing the amount of post-forming polishing required this technique permits economical finishing of otherwise hard-to-get-at areas, and decreases the wear on forming dies and tools.

Liquid abrasive compositions showed an increasing number of applications, especially in connection with fully automatic buffing equipment.

One of the important problems in the polishing and buffing field is the lack of a good practical method for judging surface quality both before, during, and after the various surfacing steps. *Gardam*¹³ proposed a simply constructed device for visual examination of semi-prepared and finished surfaces that should help a great deal in this respect.

In spite of the above signs of progress, this phase of metal finishing operations still remains as a costly and craftsmanlike procedure.

Pickling and Acid Dipping

While considerable work was done on the theory

and development of inhibitors, and a number of patents granted, nothing of any great commercial importance can be reported for the past year in this field.

Zapffe^{14,15} reported on the mechanism of pickling embrittlement of stainless steels, and gave recommendations for minimizing the problem. A report by *Weast* on the embrittlement of pickled and cadmium plated steel will be found under Cadmium Plating.

Electropolishing — Chemical Polishing

Slow but steady progress in applying these processes to industrial production was evident in the past year. One of the deterrents to much wider use of electropolishing as a method of surface preparation is the unavailability of commercial strip and sheet metals having surfaces sufficiently dense, homogeneous, and free from defects to permit the process to show its maximum utility. It is doubtful if such premium grade metal will ever be available in times when the stress is on highest production, rather than highest quality. Electropolishing, therefore, may for a long time be confined to the status of a final finishing step only. At present, stainless steel is the only metal electropolished on a commercial scale, although an occasional reference may be found to smaller installations for processing non-ferrous metals. As a substitute for color buffing, electropolishing is being used commercially to impart luster to silver and nickel plated parts.

Interest in the process is as great as ever, as evidenced by the amount of fundamental research done during the past year. *Walton*¹⁶ confirmed the role of the viscous anode layer in electropolishing copper, and calculated the effective thickness of this layer to be about 10^{-3} cm. *Francis* and *Colner*¹⁷ noted a "cycling" effect when electropolishing silver. They found best polishing to occur when the "cycling" occurred at highest frequencies, which could be obtained with a well-regulated D.C. supply.

*Michel*¹⁸ used electropolishing as a "machining" operation to produce accurate geometrical shapes, and reported on the variables of such usage. *Hoar* and *Mowat*¹⁹ found that nickel could be electropolished in a molten urea-ammonium chloride mixture.

As might be expected, a number of new baths were developed and patented. *Larke* and *Wicks*²⁰ perfected a bath for commercially pure aluminum and magnesium, as well as Al-Ag alloys, and a British patent²¹ was granted for a sulfuric-glycoether polishing bath for aluminum. *Weisner*¹⁰⁶ likewise patented a bath for electropolishing copper alloys. *Hammond* and *Bowman* patented²² a phosphoric-alkali phosphate bath for anodic polishing of iron and steel, to add to the already complicated U. S. patent picture on electropolishing baths.

A number of firms developed commercial baths for chemical (immersion) brightening and polishing of aluminum alloys, and a British patent²³ gave details of a number of suitable bath compositions for this purpose.

Alkaline Cleaning — Emulsion Cleaning

New activity in this field was confined for the most part to methods of evaluating cleaners and cleaning



Set-up for measuring radioactivity in connection with alkaline cleaner evaluation. This is the most promising technique for this type of study.

results. The long-awaited accurate and scientific test for evaluating cleanliness seems to have arrived in the form of a new radioisotopic technique.^{24,25} Amongst other things, the method is more sensitive than the common "water break" or copper sulfate tests, and in addition eliminates the controversial visual evaluation.

Tiers,²⁶ in a series of articles on cleaner evaluation, stressed the need for using a "standard" soil. This is a significant point, and vital to future progress in this line of research.

Emulsion type cleaners are being more widely used, the emulsion clean-alkaline clean combination taking the place in many cases of the former vapor degrease-alkaline clean cycle. This is particularly true where impacted buffing compound complicates the cleaning picture. The high cost of chlorinated solvents is also a factor, of course.

While di-phase type cleaners are being used to some extent, there is no evidence that their use will become widespread. One commercial firm announced methods for making efficient di-phase cleaners,²⁷ and a paper by Schmerling²⁸ discussed the requirements and characteristics necessary for efficient emulsion cleaning compositions.

Plating

COPPER

The most important happening in copper plating was, of course, the use of much heavier deposits as undercoats for nickel and chrome, with the object of conserving critically short supplies of nickel. On many commercial items as much as $\frac{2}{3}$ of the nickel thickness was replaced with copper.

The factors affecting the levelling action of cyanide copper baths using periodic-reverse techniques were discussed by Jernstedt.²⁹ The most important points for good levelling are freedom from organics, current densities above 25 a.s.f., and a relatively long deplating time.

One new acid bright copper bath was described;³⁰ sulfonated brighteners were used to produce a ductile, yet very bright plate. Current densities of 70 a.s.f. could be used. A significant levelling effect was also claimed for this bath. An alkanesulfonate bath for copper was patented by Proell.¹⁰⁹

NICKEL

Because it is the most widely used of all plated metals, nickel plating came in for a good deal of study during the past year, with special emphasis on the levelling function. Weisberg³¹ discussed means for improving the levelling power of cobalt-type bright nickel baths. The formic acid was found to be the most effective constituent regulating levelling. No correlation between levelling and brightening action was found.

One new commercial nickel bath³² was introduced which seems to have both good brightening action combined with good levelling characteristics, a combination much desired by the plating field. Although it is now being used in production work, evaluation will have to await further experience.

Fluoborate baths for both still and barrel nickel plating were described by Roehl & Wesley,³³ and O'Connor.³⁴ The outstanding characteristics of such baths are ductility of the deposits, ease of control, insensitivity to impurities, and high plating rates. Bright deposits can be obtained using appropriate addition agents.

The techniques of applying nickel plate were augmented by methods for producing adherent deposits on high-chromium alloys,³⁵ and direct deposits on die-castings.³⁶ The latter involved the use of a high-tartrate bath. Wesley³⁷ reviewed the techniques available for immersion nickel deposits, with a critical discussion of the merits of the processes.

Further verification of the often-observed fact that organic-type nickel deposits do not seem to have the same protective value as do dull nickel deposits was given by Flowers & Kelley.³⁸

The effect of small amounts of copper (as impurity) on the properties of bright nickel plating were investigated.³⁹ As little as 10 p.p.m. were found to cause a loss in brightness, a loss in salt spray resistance, a loss in ductility of the deposit, and a loss in throwing power. The losses became greater with increasing amounts of copper. Hardness of the deposit increased with increases in the copper.

Eight new patents were issued during the year for additional brightening agents for nickel baths.

CHROME

About the only new progress in this field seems to be the wider use of barrel plating and the new self-regulating type bath.

The chrome plating bath continued to be the object of much study, however. Rogers and Burr⁴⁰ studied the sulfate ion effect, and concluded that its principal benefit comes from retarding hydrogen evolution, rather than catalyzing the plating reaction. Snively and Faust⁴¹ studied the effect of annealing hard chrome deposits, and Costa⁴² gave methods for regenerating chromic acid solutions by ion exchange methods. This should prove helpful in conserving chromic acid and regenerating contaminated solutions. A new chrome bath using hydrofluoric acid and organic acids was patented by Raab.¹⁰⁵

A method for plating chrome directly on aluminum was announced.⁴³ It involved wet blast cleaning, leaving the protective film of water and inert abrasive on

the parts, and immersing directly into the chrome bath. The inert abrasive settles to the bottom of the tank.

In the course of research on porosity,⁴⁴ it was brought out that deposits of chrome over .00016" offered increasingly less protection to the underlying nickel.

ZINC

The past year witnessed a rather unusual condition with respect to zinc — an actual shortage existed for the pure electrolytic grade, especially during the latter part of the year. Plating was not affected greatly, however; in fact, there was a notable switch to zinc from cadmium, due to the ever-increasing high price and unavailability of the latter. The National Production Authority encouraged such substitution by exempting zinc from limitation provisions wherever it was used to replace cadmium plating.

CADMIUM

The fortunes of cadmium plating took a turn for the worse during the past year. With the price of the anodes going to \$2.85 per lb. (when you could get it), it is to be expected that alternate finishes, notably zinc, would be substituted wherever possible. One application where cadmium showed a decided superiority over zinc, however, was in electronic equipment, where the plating came in contact with various insulating materials which released acid compounds and promoted attack.⁴⁸ Special applications such as this will always require cadmium, but the trend otherwise seems to be toward cheaper coatings.

One patent for a bright cadmium bath was issued to *Weisberg*.⁴⁹ A coffee extract was used as a brightening agent.

TIN

One of the more important indications of the growth in tin plating is the fact that during the year the total output of electroplated tin sheet and strip, which in 1949 amounted to slightly better than half of all tin-coated steel, rose to approximately 65% of all tinplate. The inherently better qualities and uniformity of electro-tinned steel should further this trend, now that efficient, large-scale automatic equipment design has been perfected and proven.

*Parkinson*⁵⁰ discussed a high-speed fluoborate bath, and found that 4:4'-dihydroxydiphenylsulfone as an addition agent proved very satisfactory. (This addition agent is covered by British patent 555,929.) With this bath .001" of tin could be deposited in 4½ minutes at 100 asf. Anode efficiency and bath stability are easily controlled.

SILVER

Silver plating is one of the few fields not plagued by metal shortages (except, of course, the metal to be plated upon!). Interest in this field during the past year was concentrated principally on brighteners and periodic reverse plating. So far, nothing has come along to replace the time honored carbon disulfide or ammonium thiosulfate additions.

One firm⁵¹ introduced a completely soluble form of double silver cyanide, which should simplify bath makeup, and a patent for a pyrophosphate silver bath was granted to *McCoy*.⁵²

A method for heavy electroplating of silver on alloy steel shells for bearing purposes was described by *Wright*.⁵³ A unique auxiliary anode containing granular silver was used.

ALLOY PLATING

In recent years the investigation of alloy plating systems has been very actively pursued, 1950 being no exception. In terms of practical results, however, about the only alloy baths to achieve any commercial success are the speculum (copper-tin) baths and the tin-zinc alloys. The latter shows promise in replacing cadmium, especially where solderability is a factor.⁵⁴ The corrosion resistance of this group of alloys as compared to cadmium and zinc was investigated by *Halls*,⁵⁵ as well as the comparative solderability; corrosion resistance was found to be equal to, and solderability and spot-weldability slightly better than cadmium or zinc.

Further experience with speculum plating has brought about a bright deposit from commercial baths,⁵⁶ using organic brighteners and a small amount of lead. The brightness of such deposits was found to depend on small crystal size and preferred orientation.⁵⁷ A new copper-tin bath, using a single anode system, was patented by *Lowenheim*.¹¹⁰

While there seems to be no immediate practical application for the deposits, baths were developed for plating alloys of copper-cadmium;⁵⁸ tin-cadmium;⁵⁹ tin-lead;⁶⁰ chrome-indium;⁶¹ nickel-rhenium;⁶² chrome-tungsten;⁶³ lead-indium (from a single bath),⁶⁴ and iron-cobalt,⁶⁵ and chrome-molybdenum.¹⁰⁴

One group of alloy deposits which could have commercial possibilities, the nickel-phosphorous alloys,



Measuring the surface roughness of plated parts to determine the levelling power of a plating bath. The instrument is a Brush Surface Analyzer.

were described by *Brenner* and his associates.⁶⁶ The baths are easily operated, contain no organics for brightening, have good throwing power, rapid deposition rates (compared to chrome), and have a hardness up to 720 Vickers. This hardness can be increased by a suitable heat treatment. Deposits obtained are commercially bright.

An immersion brass plating bath was patented by *Balden and Morse*.⁸⁶

MISCELLANEOUS METALS

*Soderberg and Pinkerton*⁶⁷ described a bath for producing semi-bright, ductile deposits of antimony. The deposits were said to have an appearance and tarnish resistance similar to chrome, with a salt spray resistance similar to nickel-chrome coatings. The deposits were easily buffed to a high luster. A patent was granted to *Chester*¹⁰² for an alternating current method for producing more uniform antimony electrodeposits.

A patent was granted to *Miner & Klekamp*⁶⁸ for a non-aqueous plating bath for zirconium, and another to *Ma & Offinger*⁶⁹ for a molybdenum plating technique. Another molybdenum bath was patented by *Yntema & Ksychi*.⁷⁰

A palladium bath, using soluble palladium anodes, was described by *Wise*,⁷¹ and an indium cyanide bath was patented by *Green & Salmon*.⁷²

An immersion gold coating process was the subject of a patent granted to *Porter & Jones*.⁷³

Plating on Aluminum

An excellent critical review of the methods available for successful deposition on aluminum alloys was given by *Keller*.⁷⁴ Any or all of the described techniques could become quite important during a war, when much more plating on aluminum is done. *Bryan*⁷⁵ outlined methods for etching aluminum for direct plating, and described a test for checking the suitability of the surface for plating.

Methods for plating hard chrome directly on aluminum were given by *Gebauer*⁷⁶ and *DuMond*,⁴³ and a

patent was granted to *Watson & Ward*⁷⁷ for a nickel-tin strike for promoting adhesion of deposits to aluminum alloys.

Hydrogen Embrittlement

The ever-popular subject of hydrogen embrittlement during zinc and cadmium plating was reported on by *Zapffe and Haslem*,⁴⁵ using their quantitative bend test as a means of evaluation. They found that mild steel is embrittled less in zinc or cadmium plating than it is during cathodic pickling; stainless steels in particular are severely embrittled during zinc and cadmium plating. Acid plating baths for both cadmium and zinc were found to be much less damaging than the cyanide baths.

These authors also investigated⁴⁶ nickel, tin, and lead plating in the same manner. Among other things, nickel plating had only a very minor effect on carbon and stainless steels, and plain Watts bath plating was less destructive than organic bright bath plating. Acid tin plating caused damage similar to acid zinc plating, whereas alkaline (sodium) stannate baths produced the severest embrittlement. In lead plating, dilute fluoborate lead baths had practically no injurious effect, even on stainless steel, and are ranked about equal to the dull Watts bath.

*Weast*⁴⁷ found that a lapse of time (24 hours or more) between acid pickling and cadmium plating materially reduced hydrogen embrittlement. Room temperature aging after plating also helped.

Testing and Analysis

Along with the increased interest in the levelling function of plating baths there was a search for better methods for measuring and evaluating the surface conditions affecting deposition and the surface contours produced in plating baths. The methods now in current use are not particularly well adapted to the range of 2 micro-inches and below, which is the range for "bright" and "levelling" deposits. The interference microscope and the Faxfilm techniques, as described at the A.E.S. Symposium in June,⁷⁸ seem to be the most promising new measuring methods in this range, although both of these are definitely laboratory methods. Taper sectioning, as described by *Rabinowicz*,⁷⁹ is another possible technique of value in this range.

A very interesting investigation on the reflectivity of various metals was made by *Unckel*.⁸⁵ Various conditions of surface polish and various colors (wavelengths) of light were used.

What appears to be an excellent new quantitative method for measuring adhesion of deposits was developed by *Brenner & Morgan*.⁸⁰ It has the advantage of being able to check adhesion in the usual range of commercial thicknesses.

In regard to chemical analytical methods, considerable progress was noted in the use of colorimetric methods for plating solution control, and a number of new techniques developed. Among these were methods for impurities in copper baths,⁸¹ impurities in nickel baths,⁸² and chrome in zinc baths.⁸³

*Heiman*⁸⁴ conducted extensive investigations on accurate methods for brass solution analysis, and devel-



Double machine set-up for flat polishing sheet material before press operations. This saves later polishing on shaped parts.

oped methods for ammonia and "free" cyanide which overcome the inaccuracies of the commonly used methods.

Waste Disposal

Favorable progress in this field can be reported for the past year. The plating industry is at last waking up to its responsibilities, and while treatment of plating wastes is not yet universally practiced, it is being given the necessary thought and planning. From here it will be a fairly steady progression to efficient waste disposal installations. Methods and know-how are now available for every size plant, so this is no longer a deterrent.

Special Surface Treatments

PLATING POWDERED METAL PARTS

With the increasing use of powdered metal parts as components in plated assemblies, considerable attention was directed over the past year toward overcoming the difficulties in successfully plating these inherently porous materials. *Kusmick*⁸⁷ described a sintering-after-plating technique, and *Symonds*⁸⁸ gave a method for plating impregnated castings, using a special resin filler which would permit adherent, continuous plating. A patent was granted to *Tinker*⁸⁹ for a powder-metal plating technique involving a preliminary alkaline impregnation, and another patent⁹⁰ was issued covering a similar preliminary alkaline treatment before plating.

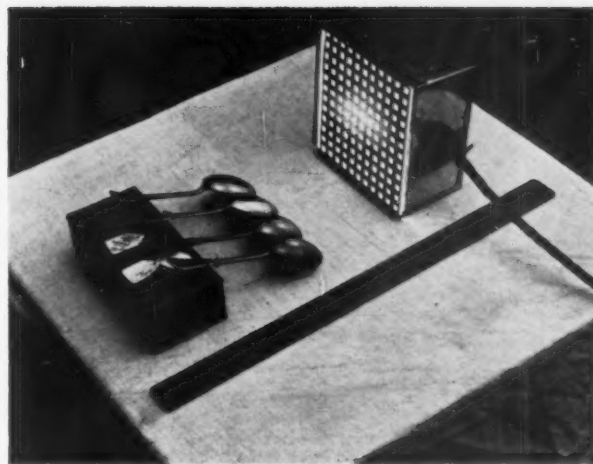
GASEOUS PLATING

While very little was published on this technique during the past year, it is known that a considerable amount of work has been done on secret military projects using gaseous plating. Several new patents were reported; one to *Metal Gas Co.*⁹¹ for halide decomposition methods; one to *Germer & Reiter*⁹² for a method for plating the inside of gun barrels, and one to *Lander*¹⁰³ for coating the inside of hollow tubes. Another method for bright chromizing from the vapor phase was described by *Galmiche*.⁹³ Carbonyl plating by immersion and firing was the subject of a patent issued to *Young and Angelillo*.¹⁰⁸

OXIDE COATINGS

*Naylor*⁹⁴ described methods for producing brown, blue, bronze, reddish-brown, purple, and green films on stainless steel by an electro-chemical process, while *Hornak and Halbig*¹⁰⁷ obtained a patent on a similar process. *Silman and Love*⁹⁵ made an extensive evaluation of black oxide finishes on steel, and found that the un-oiled or un-waxed films offered practically no resistance to corrosion.

An investigation by *Stickley and Howell*⁹⁶ showed that anodic coatings up to .0005" thick had practically no effect on the fatigue life of aluminum alloys, even those whose design permitted severe stress raisers. *Napier and Westwood*⁹⁷ reported on the discrepancies between actual and theoretical anodic coating thicknesses on aluminum. They ascribed the differences to the solubility effect of the bath on the film, and concluded that much more work of this kind would be necessary to complete understanding and efficiency of the process. A new process for imparting a hard, wear-



Instrument for evaluating the degree of polish on a metal part. Reflection of the grid and distance from the lamp are the two factors involved.

resistant finish on aluminum alloys was perfected by *Burrows*.⁹⁸ The hardness and wear resistance was similar to hard chrome plated surfaces.

*Halls*⁹⁹ compared the corrosion resistance of a wide range of treatments for magnesium alloys, and found no difference between mild and strong chromate treatments.

METALLIZING

A survey of methods for coating steel with aluminum was reported on by *Stroup and Purdy*,¹⁰⁰ and included data on cost and relative merits of each type of coating.

A familiar name cropped up again in the patent literature, as *C. G. Fink* was granted a patent¹⁰¹ for aluminum coating metals by hot dipping, using submerged jets of hydrogen to provide a suitable atmosphere.

Equipment

One or two basically new developments in the equipment field were introduced during the past year. The first of these involved the use of oil immersed stacks in commercial plating rectifiers — the first step towards the British type of completely oil immersed rectifiers. The other development of importance was the successful introduction of polyethylene and tetrafluoroethylene plastics as tank linings. Both of these materials are outstanding in their chemical resistance and will undoubtedly be widely adopted by the plating equipment manufacturers.

References

1. AES Research Report—Plating—March 1950, p. 280.
2. AES Research Report—Plating—July 1950, p. 749.
3. U. R. Evans & S. C. Shome—Paper presented at *Electrodepositors Tech. Soc. Annual Conference*—April 1950.
4. AES Research Project #11—Plating—August 1950, p. 851.
5. *Electrodepositors Technical Society Meeting*—London. *Metal Industry*—Jan. 27, 1950.
6. C. E. Reinhard—Paper presented at *A.E.S. Convention*—Boston—June 1950.
7. A. Brenner & S. Senderoff—*Journal Electrochemical Society*—Nov. 1950, p. 361.
8. J. Kronsbein—Paper presented at *A.E.S. Convention*—Boston—June 1950.
9. J. C. Harris & R. Kamp—*Metal Finishing*—Nov. 1950, p. 75.

10. T. F. Clark & E. C. Lathrop—*Materials & Methods*—May 1950, p. 67.
11. E. I. du Pont de Nemours Co.
12. British Patent 640,593. Doehler-Jarvis Corp. (U.S.A.)
13. G. E. Gardam—*Journal of Electrodepositors Tech. Soc.*—1950, 26.
14. C. A. Zapffe—*Materials & Methods*—Oct. 1950, p. 58.
15. C. A. Zapffe—*Materials & Methods*—Nov. 1950, p. 74.
16. H. F. Walton—*Journal Electrochemical Society*—July 1950, p. 219.
17. H. T. Francis & W. H. Colner—*Journal Electrochem. Soc.*—Aug. 1950, p. 237.
18. P. Michel—*Sheet Metal Industries*—Marcy 1950, p. 267.
19. T. P. Hoar & J. A. S. Mowat—*Journal Electrodepositors Tech. Soc.*—1950, 26.
20. L. W. Larke & E. B. Wicks—*Metallurgia*—Jan. 1950, p. 172.
21. British Patent 627,854. United Anodizing, Ltd.
22. U. S. Patent 2,493,579. Assigned to Standard Steel Spring Co.
23. British Patent 625,834. United Anodizing, Ltd.
24. J. C. Harris & R. E. Kamp—*Metal Finishing*—Nov. 1950, p. 75.
25. J. C. Harris, R. E. Kamp, W. H. Yanko—*Paper presented at Electrochem. Soc. Meeting—Buffalo*, 1950.
26. R. H. Tiers—*Metal Finishing*—April 1950 and Sept. 1950.
27. *Metal Finishing*—July 1950, p. 78.
28. G. Schmerling—*Journal Electrodepositors Tech. Soc.*—1950, 26.
29. G. Jernstedt—*Paper presented at A.E.S. Convention—Boston*—June 1950.
30. C. J. Slunder, A. E. Bearse, C. L. Faust—*Plating*—Oct. 1950 & Nov. 1950.
31. L. Weisberg—*Paper at A.E.S. Convention—Boston*—June 1950.
32. *Smoothex Process*—Gill Corp., Cleveland, Ohio.
33. E. J. Roehl & W. S. Wesley—*Plating*—Feb. 1950.
34. R. J. O'Connor—*Plating*—Oct. 1950.
35. L. L. Howard—*Plating*—April 1950.
36. U. S. Patent 2,494,205. Assigned to International Nickel Co.
37. U. A. Wesley—*Plating*—July 1950.
38. L. C. Flowers and J. B. Kelley—*Ind. & Eng. Chem.*—April 1950, p. 719.
39. A.E.S. Research Report—*Plating*—Nov. 1950, p. 1157.
40. D. G. Rogers and A. A. Burr—*Journal Electrochem. Soc.*—March 1950, p. 92.
41. C. A. Snively & C. L. Faust—*Journal Electrochem. Soc.*—March 1950, p. 99.
42. R. L. Costa—*Ind. & Eng. Chem.*—Vol. 42, Feb. 1950, p. 308.
43. T. C. Dumond—*Materials & Methods*—Oct. 1950, p. 56.
44. A.E.S. Research Report—*Plating*—June 1950, p. 631.
45. C. A. Zapffe & M. E. Haslem—*Plating*—April 1950, p. 366.
46. C. A. Zapffe & M. E. Haslam—*Plating*—June 1950, p. 610.
47. R. Weast—*Paper presented at Electrochem. Society Meeting, Buffalo*—Oct. 1950.
48. P. T. Gilbert and S. E. Hadden—*Journal Electrodepositors Tech. Soc.*—1950, 25, 41-49.
49. U. S. Patent 2,497,806. Assigned to Lea Mfg. Co.
50. N. Parkinson—*Jour. Electrodepositors Tech. Soc.*—1950, 26.
51. Bart-Messing Corp.—Brooklyn, N. Y.
52. U. S. Patent 2,504,272. E. W. McCoy.
53. O. Wright—*Paper delivered to Electrodepositors Tech. Soc.*
54. *Steel*—Nov. 20, p. 118.
55. E. E. Halls—*Metal Finishing*—April 1950, p. 54.
56. P. S. Bennett—*Journal Electrodepositors Tech. Soc.*—1950, 26.
57. H. P. Rooksby—*Journal Electrodepositors Tech. Soc.*—1950, 26.
58. E. E. Langhurst—*Journal Electrodepositors Tech. Soc.*—1950, 25.
59. P. S. Bennett—*Journal Electrodepositors Tech. Soc.*—1950, 26.
60. U. S. Patent 2,489,523. Assigned to General Motors Corp.
61. N. Hackerman & T. Jensen—*Paper presented to Electrochem. Soc. Meeting, Buffalo*, 1950.
62. L. E. Netherton & M. L. Holt—*Paper presented at Electrochem. Soc. Meeting, Buffalo*, 1950.
63. D. G. Rogers and A. A. Burr—*Jour. Electrochem. Soc.*—Feb. 1950, p. 67.
64. British Patent 637,159.
65. U. S. Patent 2,507,400. Assigned to S. K. Wellman Co.
66. A. Brenner, D. E. Couch and E. K. Williams—*Bureau of Standards Journal of Research* 44, 109 (1950) RP 2061.
67. K. G. Soderberg & H. L. Pinkerton—*Plating*—March 1950, p. 251.
68. U. S. Patent 2,510,128—Assigned to Tung-Sol Lamp Works, Inc.
69. U. S. Patent 2,512,141—Assigned to Westinghouse Electric Corp.
70. U. S. Patent 2,499,808—Assigned to St. Louis University.
71. E. M. Wise—*Paper delivered to Electrochem. Soc. Meeting—Cleveland*, 1950.
72. U. S. Patent 2,497,988—Assigned to Vanderwell Products, Ltd.
73. U. S. Patent 2,501,937—R. W. Porter & C. M. Jones.
74. R. H. Keller—*Plating Notes*—Dec. 1949, p. 66.
75. J. M. Bryan—*Journal Electrodepositors Tech. Soc.*—1950, 26.
76. K. Gebauer—*Metal Industry*—London—March 10, 1950.
77. British Patent 626,693. H. R. Watson & A. T. Ward.
78. *Papers presented at A.E.S. Boston Convention*—June, 1950.
79. E. Rabinowitz—*Metal Industry*—London—Feb. 3, 1950, p. 63.
80. A. Brenner & V. D. Morgan—*Paper presented at A.E.S. Boston Convention*—June 1950.
81. *Plating*—Jan., Feb., April, May, 1950.
82. L. Silverman—*Metal Finishing*—May, July, 1950.
83. *Plating*—Oct. 1950, p. 1057.
84. S. Heiman—*Plating*—May, July, Aug., Sept., 1950.
85. A. H. Unckel—*Sheet Metal Industries*—July 1950, p. 654.
86. U. S. Patent 2,496,845. Assigned to Chrysler Corp.
87. J. F. Kuzmich—*Materials and Methods*—June 1950, p. 54.
88. H. H. Symonds—*Metal Industry*—London—June 16, 1950, p. 474.
89. R. B. Tinker—Assigned to General Electric Co.
90. British Patent 636,736—British Thomson-Houston Co., Ltd.
91. British Patent 633,701—Metal Gas Co., Ltd.
92. U. S. Patent 2,508,509. Gerber & Reiter.
93. P. Galmiche—*Sheet Metal Industries*—August 1950, p. 749.
94. C. E. Naylor—*Plating*—Feb. 1950, p. 153.
95. H. Silman & B. E. Love—*Journal Electrodepositors Tech. Soc.*—1950, 25, 65-76.
96. G. W. Stickley & F. M. Howell—*Paper presented at A.S.T.M. Meeting—Atlantic City*—June, 1950.
97. D. H. Napier and J. C. Westwood—*Metal Industry*—London—Feb. 17, 1950.
98. C. F. Burrows—*Metal Finishing*—Nov. 1950, p. 61.
99. E. E. Halls—*Electroplating*—May, 1950, p. 339.
100. P. T. Stroup and G. A. Purdy—*Metal Progress*—Jan. 1950, p. 59.
101. U. S. Patent 2,497,119. Assigned to Alwac Co., Inc.
102. U. S. Patent 2,515,192. Assigned to Poor & Co.
103. U. S. Patent 2,516,058. Assigned to Bell Telephone Lab., Inc.
104. U. S. Patent 2,516,227. Assigned to Westinghouse Electric Corp.
105. U. S. Patent 2,517,441. Assigned to Ductile Chrome Process Co.
106. U. S. Patent 2,521,106. Assigned to C. G. Conn., Ltd.
107. U. S. Patent 2,521,580. Assigned to Armco Steel Co.
108. P. S. Patent 2,523,461. J. T. Young and O. R. Angelillo.
109. U. S. Patent 2,525,943. Assigned to Standard Oil Co.
110. U. S. Patent 2,528,601. Assigned to Metal & Thermit Corp.

The busy job shop uses all types of cleaning baths and cleaning methods.



Metal Cleaning

By D. W. Vance, Chief Chemist, Kelite Products, Inc.



Donald W. Vance, Chief Chemist, Kelite Products, Inc., completed his undergraduate work at Stanford University and graduate work at the University of Southern California.

Previous experience included research work for California Cyanide Co., Crystal Chemical Co., and Petrol Corp. He is a member of

The American Chemical Society and American Electroplaters Society, and a Licensed Chemical Engineer.

METAL cleaning involves more than just removing dirt; it must be adequate for the subsequent operations. Preparation for subsequent operations may involve the cleaning necessary before and after annealing operations, or before nitriding, cyaniding, electroplating, phosphate coating, enameling, painting, or other protective or decorative coatings. Each process does not require the same degree of cleanliness.

Dirt to be removed from metal surfaces may be a single substance or a complex mixture intentionally or unintentionally applied to the work. Drawing or buffing compounds, for example, are applied intentionally,

but must subsequently be removed from the metal surface. From the cleaning viewpoint, dirt consists of organic substances, solid particles, and products of corrosion. Principal organic impurities are oils, greases, soaps, drawing, polishing, and buffing compounds, and similar materials used in processing. Furthermore, oils may be vegetable, animal, mineral, or compounded. Solid dirt particles are metal chips, abrasive grains, drawing compound pigments, and shop dirt of all kinds that are naturally picked up during processing and handling. Corrosion products are the oxides, scales, rust, various sulphides, sulphates, carbonates and chlorides that may be present.

Factors in Selecting a Cleaner

All these kinds of so-called dirt affect the selection of the cleaning agent and method, because a cleaner only suitable for an oily surface would not be adequate for the surface covered with oil and solid dirt particles or scale.

The adherence of the dirt to the surface is equally important in determining the required characteristics of a cleaner. The wetting power, penetration, detergency, emulsification, saponification, deflocculation, suspension, rinsibility, and related properties are the important features to be considered in the selection of a metal cleaner.

The degree of cleanliness required is important in the selection of a cleaner. An organic finish requires the removal of all visible surface dirt, while a plated coating demands a removal of all traces of oil, grease, and solid particles as well as oxides and other corrosion products. Such surfaces should show a negative water break; in fact, any impurities that might affect the adhesion, appearance, or the protective requirements of the plating should be removed, even though

it is recognized that successful plating can be done over some surface films. (The physical act of transferring parts from the rinse after the pickling bath into the plating tank results in some oxidation and leaves a minute film.)

It should be recognized at the start that there is no simple test to ascertain closely the degree of cleanliness of the surface. Visual inspection is not infallible; the "water break test" is not always a reliable indicator, failing when colloidal films, as from the decomposition of some silicates in an alkaline cleaner, are deposited on the work.

Because the selection of the cleaner and the success of the cleaning operation depends so much on the nature of the dirt, plating and cleaning should be considered as a single production problem. Cleaning costs can be reduced in many cases by changing the compounds used in previous operations. Removal of heavy deposits of tripoli compounds has always been a problem, especially when the work has been allowed to stand for some time after buffing and the compound has set on the work. Cheap compounds generally employ substances difficult to remove to bind the abrasive particles together, while the better grades contain tallow, stearic acid or water-soluble binders. Even saponifiable binders are not easy to remove, because the residue on the buffed work is a mixture of binder material, abrasive, metal particles, and insoluble soaps formed by the action of the heat generated during buffing. Practically all buffing compounds require extensive cleaning set-ups. It may be necessary to precede the alkaline cleaner with soak tanks of soap solutions, emulsifiable cleaners, two-phase solvent emulsion cleaners, and even costly hand brushing may be employed.

Metal cleaning can be conveniently classified into four groups:

1. Organic solvents.
2. Self-emulsifying or emulsifiable organic solvents.
3. Alkaline cleaners.
4. Acids.

Successful preparation of steel parts for subsequent operations may, and usually does require the use of more than one type. While either a solvent or an alkaline cleaner, for example, would effectively clean a part of oil alone, an acid cleaner would be needed if the part were to have a surface free of oxides.

Solvent Cleaners

One of the earliest and simplest methods is solvent cleaning by hand wiping, tank dipping or spraying. Cleaners of this type are kerosene, gasoline, naphthas, Stoddard solvent, and coal tar or aromatic solvents.

The purpose of solvent cleaning is to remove light coats of oil, grease, and processing dirt. Wiping is essential in removing solid dirt, as the solvent has no effect on them. The surface condition produced is not physically clean, but may be adequate for parts cleaned prior to inspection or assembly. Solvent cleaning is versatile, inexpensive, requires little equipment, and demands little skill in operators. But it is only adaptable where a slight residual oil film is permissible.

A development of solvent cleaning, vapor degreasing with chlorinated hydrocarbon solvents, was introduced in this country about 1928 and far surpassed the earlier

solvent cleaning methods. In this type of metal cleaning, high boiling solvents such as trichlorethylene or perchlorethylene are used. These chlorinated hydrocarbons, because of their low surface tension and high wetting power, have a high and rapid solvent action on organic materials, such as, fats, oils, and waxes. However, the condensation of the solvent on the metal does not produce a rate of flow great enough to flush all of the solid particles. As these particles are insoluble compounds (limes, pigments, and water soluble soaps) they are not removed. Physically clean surfaces are not obtained with vapor degreasing. Vapor degreasing should be followed by some other means of cleaning, usually alkaline cleaners, before electroplating.

Emulsion and Emulsifiable Cleaners

Self-emulsifying or emulsifiable organic solvents combine the action of a solvent and the emulsifying properties of a solvent soluble dispersing agent, or soap, in the presence of a blending agent. The hydrocarbon solvent may be kerosene or naphtha. The emulsifying agent a soap, such as potassium oleate; and the blending agent is usually an organic compound such as butyl cellosolve, cresylic acid, a cyclohexanol derivative, or a synthetic surface active material. These materials came into use about 1930 and have been particularly useful in pre-cleaning operations where surfaces are covered with smut or such adherent dirt as buffing compounds. On buffing compounds, however, an emulsion dissolved in water, plus agitation, is sometimes more effective than soaking in full strength emulsifiable cleaner, because the cleaner may not penetrate the mixture of dirt and compound. Cleaning by this method requires rinsing, preferably in hot water spray, to remove all residues. The parts leave the rinse with only a slight film of solvent on their surfaces. This film must be removed by alkaline cleaning before electroplating but does not interfere with painting or phosphatizing.

Alkaline Cleaners

Alkaline cleaners are the oldest of commercial cleaners and still, by far, the most widely used. When first used many years ago potash was the sole alkaline cleaner. They have since become highly specialized, based on sodium salts used either singly or in mixtures, as detergents. Various combinations include the older types such as caustic soda, trisodium phosphate, and soda ash, and the newer salts such as the soluble silicates. Present day cleaners obtain their required alkalinity by salts that are less dangerous to handle than the caustics.

To most cleaners water-softening agents are added. Among these are the sodium carbonates and phosphates. Phosphates are used to form flocculent calcium or magnesium phosphates, which are free rinsing, with the hard water salts. Certain of the polyphosphates are even more remarkable in their water-softening action, both by combining with the calcium so that it cannot react with the soap, and by decomposing calcium soaps already formed.

An alkaline salt alone cannot serve as a cleaner for widely diversified dirt encountered in process cleaning. First, there is needed a so-called "wetting agent" that will bring the solution into intimate contact with the dirty surface and assist in displacing the dirt from the metal surface. The action of the wetting agent is to

lower the surface tension of the solution from about 75 dynes per centimeter to approximately 30 to 40 dynes. As the surface tension of the oil is about 35 dynes, the solution can then wet or mix with oil; that is, emulsify it and assist in its removal.

Soap is a well known wetting agent, but its disadvantages are that it is difficult to rinse, and it is precipitated by the calcium and magnesium salts present in hard water. This would show as an insoluble scum in an alkaline tank. To avoid this difficulty, water softeners are added and wetting agents have been developed that are not so adversely affected by hard water. These synthetic wetting agents are complex organic compounds of many types, such as sodium salts of saturated hydrocarbons, sulphated petroleum derivatives, sulphated fatty acids, sulphated naphthalene, alkyl aryl sulphonate, and many others.

Cleaning Actions

The emulsification of oil should be distinguished from saponification. Animal and vegetable oils are saponifiable; that is, they react with an alkali to form soap. But mineral oils do not react with the alkali to form a soluble soap. Addition of a wetting agent, by reducing the interfacial tension between the cleaning solution and oil, makes possible the emulsification of the oil and eventually each drop of oil is surrounded by a film to form the emulsion.

The value of a cleaning solution, as far as its alkalinity is concerned, is largely determined by its sodium oxide content. Alkalinity and active sodium oxide content are closely related because the greater the active sodium oxide, the higher will be the pH, which for cleaning steel should be held above 12 pH.

When the pH of a soap containing solution is reduced, its detergent properties are correspondingly reduced until it loses its wetting power. To prevent this condition, cleaners are buffered by adding an excess of certain alkalies. Properly buffered solutions will maintain a fairly constant pH. The action of the alkaline type cleaner is as follows:

1. The oil and grease are removed by displacement, saponification or emulsification.
2. Soap in water forms colloidal particles which being small, have great surface. This surface attracts the dirt particles and holds them in suspension. This suspending power can be greatly increased by the use of organic colloids, some types of silicate, or aluminates.

Attraction of the dirt to colloidal particles is attributed to their electrical charge being greater than the charge on the work surface. When the colloidal particles have attracted enough dirt particles to neutralize their electrical charge, further action ceases and the cleaner must be discarded, or fresh material added to restore the deflocculating property. If the solution does not have adequate suspending or deflocculating properties, dirt particles may re-deposit on the work.

Alkaline cleaners are used in still soak tanks, and in soak tanks with electric current, which we call electro-cleaning. All types require sufficient heat to bring the solution near to the boiling point. Heat and agitation increase the activity of the solution and are important factors in successful cleaning operations.

Electrocleaning

Electro-cleaning is also used to speed up the cleaning operation. In this method of cleaning, the alkaline solution is the electrolyte, the work one pole, and the tank or a number of steel plates the other. When current is passed through the electrolyte, water is decomposed to form oxygen bubbles at the anode and hydrogen at the cathode. The continuous evolution of gas at the surface of the work breaks up the oil film, and in effect pushes off the dirt.

The work may be made either the anode or the cathode. When the work is the anode, the process is called reverse-current cleaning. Reverse current cleaning causes the evolution of oxygen on the surface of the parts to be cleaned, while direct-current, or cathodic, cleaning causes the evolution of hydrogen on the surface of the parts. Twice as much gas is liberated on the parts when direct current cleaning is employed.

In anodic cleaning of non-ferrous metals, a slight film of oxide or tarnish may form on the work. There is some danger of hydrogen embrittlement in cathode cleaning and a plating of smut on the work from deposition of metals that may accumulate in the solution. It has become the practice in electro-cleaning of non-ferrous metals to equip the cleaning tanks with a double throw switch. The parts are subjected to direct or cathodic cleaning and then to reverse or anodic cleaning in order to de-plate any smut which might have been deposited during the direct current cycle.

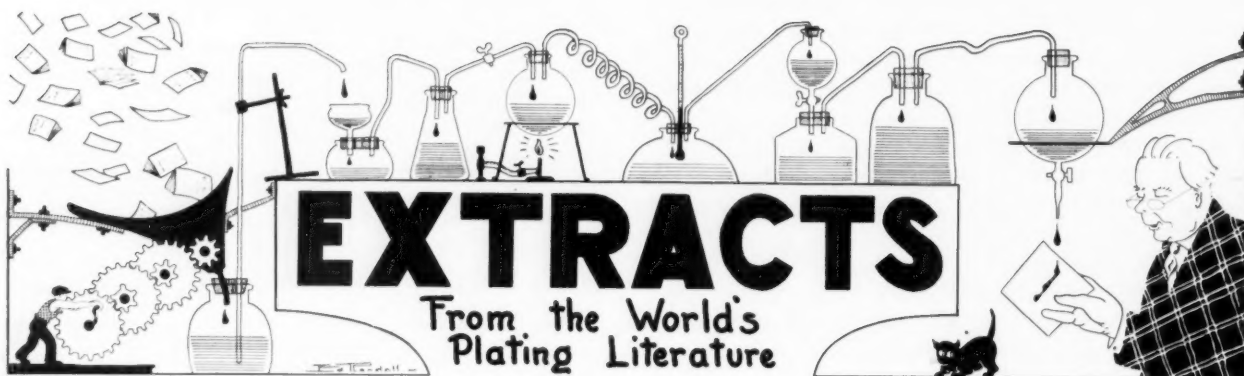
Alkaline cleaners used in electrolytic cleaning differ in composition from regular hot tank soaking materials. First of all, electrocleaners must have a high electrical conductivity. As the current passes through a solution in direct ratio to the degree of ionization, the cleaner must contain alkaline ionizable salts to prevent the current from being dissipated by the internal resistance of the solution.

Moreover, electrocleaners should not contain any ingredients such as chlorides that would dissociate and attack either electrode, nor should any soaps, colloidal or other material, be present that might plate out and deposit on the electrodes or the work. Also, organic materials that might decompose must be avoided. A constant pH must be maintained and the solution should be changed frequently to keep it clean. The tanks should be skimmed regularly and often.

Another important requirement is light foaming action and proper gassing. If a heavy foam blanket is formed, there is danger of explosion, as the mixture of hydrogen and oxygen bubbles may be detonated by a spark. The foam blanket should consist of fine bubbles that will entrap the alkali spray, yet low enough in film strength so as to break quickly after formation.

Electro-cleaning is carried on at 6-12 volts and 10-100 amperes. The higher the voltage and current, the greater evolution of gas. Recessed parts require higher voltages; current density depends on solution conductivity and ranges from 15-45 amperes per square

(Concluded on page 73)



Corrosion Resistance of Hard-Chrome Coatings

H. W. Dettner—*Metalloberflaeche*, Vol. 4 (1950), pp. A 33-37.

This article covers comprehensive research that was undertaken to establish whether the corrosion resistance of hard chrome deposits increases or decreases at lower temperatures and current densities. For every corrosion medium tested, 75 samples were plated in a hard chrome bath of composition 250 gm./l. of CrO_3 with 1% H_2SO_4 at a temperature range of 30 to 70°C., and with current densities of 20 to 80 amsp./sq. dm., so that for each bath temperature and current density, a considerable number of test pieces were examined.

It was found that the corrosion resistance of hard chrome coatings obtained under varying conditions of plating is not uniform. Hard chrome coatings show a minimum of corrosion resistance to acid media and sea water at bath temperatures between 45° and 53°C. The corrosion resistance improves both when the bath temperature is raised and lowered outside this range. The influence of the current density is as follows: at bath temperatures above the range given, the corrosion resistance is improved by decreasing the current density, while below this temperature range, the corrosion resistance is adversely effected by lowering the current density. Hard chrome coatings show considerable resistance to alkaline attack. The reason for this behaviour lies in the varying corrosion resistance of modification of the chromium which mainly occurs, which is the face space-centered chromium and the corrosion resistant hexagonal β chromium.

Cleaning of Metal Surfaces

G. Schultze—*Werkstoffe und Korrosion*, Vol. 1, No. 1, pp. 26-33.

A detailed survey is first made of the technical problems encountered in cleaning metal surfaces, as pretreatment for coating processes. Deposits to be removed may be either normal fouling, generally of a fatty nature or corrosion, or derived from the manufacture, such as scale. Mechanical cleaning by brushing, polishing or sand-blasting is generally a lengthy and unsatisfactory procedure. Solvent cleaning is best for grease removal. The use of alkaline cleaners has

expanded noticeably with the employment of inhibitors; without these the effect of the alkali may be too aggressive. The theory and application of pickling bath inhibitors is then surveyed. Details are given of the effect of inhibitors on the attack of 7% hydrochloric acid on steel at various bath temperatures. With very high pickling acid concentrations, the effective life of the organic inhibitive compound is shortened; on the other hand, too low an acid concentration increases the pickling time required. The bath concentration should not pass below a minimum value of 15% H_2SO_4 or 5% HCl respectively. Details are then given of the effect of the various factors involved on the working of inhibitors — these are the acid, temperature and the nature and composition of the metal being treated. A survey is finally made of the commercially useful pickling bath inhibitors.

Effect of Inhibitors in Hydrochloric Acid Pickling

K. Wickert, E. Boehnert and H. Pilz—*Werkstoffe und Korrosion*; Vol. 1, No. 3, pp. 106-107.

A study was made of the influence of inhibitors on the pickling action of hydrochloric acid on Armco iron. The research established that the inhibitive action was only effective over the later part of a test immersion of 20 seconds. It was confirmed that the speed of metal solubility in the first few seconds of immersion is particularly high. The reason for this is the presence on the ferrous surface of points of high activity, which subsequently disappear by the solvent action of the acid. The surface condition of the metal influences the effect of the inhibitor in the pickling bath.

Electropolishing of Steel

E. Darmois, I. Epelboim, D. Amine and C. Chalin; *Revue de Metallurgie*, Vol 47, No. 3 (March 1950), pp. 183-186.

The electrical resistance of the anodic film and the optimum composition of the electropolishing baths are considered. Relatively little is actually known fundamentally of the composition of acids which can enter into the formulation of electropolishing baths. Numerous formulae are given in the technical literature but

these are mainly empirical. The best polishing conditions can be correlated with a maximum resistance of the bath and this method was used as a study basis of the electropolishing of steel. Research was conducted on the variation of the optimum electropolishing effect as a function of several variants, particularly the composition of the electrolyte and of the quantity of metallic ions removed by the polishing. The research method was to dissolve by electropolishing a determined quantity of metal and then to measure the maximum resistance of the anodic film. This resistance itself reached a further maximum for a certain bath composition and this composition is that of the bath giving the best electropolishing effect. The work was conducted on samples of Armco iron polished electrolytically in perchloric acid-acetic anhydride baths of variable concentration.

Plating as a Pretreatment for Deep Drawing of Steel

H. Hauttmann; *Archiv fuer Eisenhuettenwesen*, Vol. 21 (1950), pp. 235-242.

The author discusses the fundamental features of the Neumeyer deep drawing process for the cold pressing and forming of steel. The steel parts, that have been electroplated with copper or zinc, with the addition of a high-pressure lubricant drawing aid, in experimental test pressings were found to give lower forming pressures; lead-coated parts required higher pressures. A comparison of this deep-drawing surface preparation process with a phosphatized deep-drawing surface showed about the same results in the case of a zinc coating. Phosphate coatings can be very easily removed, subsequent to the drawing, by pickling, but difficulty is encountered in removing the zinc coatings.

Tests regarding the influence of the land-angle of the press die were found to give the lowest pressures for small angles and the most favorable flow of the material. For testing the cross-sectional strength of thin-walled tubes which are produced by the Neumeyer deep-drawing process, an apparatus is described for conducting the ring-punch tensile test.

Laboratory Testing of Corrosion and Pickling Inhibitors

W. Wiederholt and B. Thiede—*Metalloberflaeche*, Vol. 4 (1950), pp. A 25-28.

The work covers a survey of test methods for chemical inhibitive compounds; attack of pickling bath inhibitors on ferrous metals; testing of the corrosion-inhibitive effect of pickling bath inhibitors. The characteristics of bath inhibitors are then considered and the testing of inhibitive auxiliaries, and finally a survey is given of known processes.

Attack of Hot Impregnating Oil on Hot-Dip Tinplate

G. Schikorr; *Werkstoffe und Korrosion*, Vol. 1, No. 1, pp. 2-3.

Very little information is available in the technical literature on this subject. A commercial food-can tinplate 0.3 mm. thickness was investigated together with

a commercial impregnating oil. Tests were conducted on the non-agitated oil to determine the total amount of attack conferred by the oil and to ascertain the degree of corrosion protection afforded. Two possible courses are open to prevent or minimize the attack of the impregnating oil on the steel — these are washing out the aggressive constituents with water or their neutralization with alkalis. The tests showed that washing the oil serves to reduce the attack of the aggressive constituents but is difficult to effect practically. Addition of calcium oxide (lime) reduces the corrosion to negligible amount and is a simple process to carry out. About 1% of calcium oxide is sufficient. A non-treated impregnating oil was found to corrode the steel sheet to a considerable extent.

Thermoplastic Synthetic Resin Linings for Plating and Pickling Tanks

W. Krannich; *Werkstoffe und Korrosion*, Vol. 1, No. 1, pp. 12-16.

Of the thermoplastic synthetic resins, polyvinylchloride and polyisobutylene have achieved most importance as lining materials for chemical processing vessels, such as plating and pickling tanks. Chemical attack on plastic linings of this nature involves factors different from those ruling in the case of attack on metals. In the latter case chemical attack invariably occurs; with plastics, no chemical reaction occurs and no protective layer preventing further attack can be formed. Penetration also occurs into the plastic lining until the complete thickness is saturated with the aggressive medium. The effect of temperature has to be considered. With hard polyvinylchloride up to 60°C. no damage is suffered by the lining; this temperature must be regarded as a limiting factor in use. Attack on these plastic lining generally decreases with rising concentration of the salts. The linings are resistant to concentrated sulphuric acid of all strengths up to 95% and 60°C.

Surface Properties of Hard Chrome Coatings

W. Eilander, H. Arend and H. W. Dettmar; *Metalloberflaeche*, Vol. 4, No. 5, pp. 69-71, (1950).

The desired objective with plated deposits is to obtain a uniform metal distribution over the whole coating. The influence of chrome plating on the surface properties was investigated with various foundation surfaces, on 100 hard-chromed test pieces of 12 mm. diameter and 60 mm. length. Chrome plating was conducted at 30-50 amps./sq. dm. at 45-65°C. with 0.8 to 1.2% sulphuric acid in the bath. The test pieces were given the following pretreatments before chrome plating: (a) Electropolished; (b) Machine ground; (c) hand polished 1; (d) hand polished 2 and (e) turned. The electropolishing was conducted in a phosphoric acid-sulphuric acid bath (80% H_3PO_4 — 20% H_2SO_4). The hard chrome plating made the surface rougher; this was particularly observed with the finest worked surfaces but the roughness did not attain the initial condition. This means that for hard chrome plating, particular care must be taken with the surface-preparation of the components. Electropolished surfaces showed themselves as particularly good in this respect. The most favorable values also were given in the

corrosion tests with electropolished surface preparation.

Supervision of Hard-Chrome Baths

G. Dehmelt, *Metalloberflaeche*, Vol. 4, No. 7, pp. B 105-106.

Factors causing changes in plating bath compositions in operation are discussed and general methods of bath supervision and control considered. Taking samples from the bath for examination at regular intervals of time is only of value where the tank is being charged and operated regularly and uniformly. A method is given which has proved of value for bath control in several hard chrome plating plants. Detailed calculations are given showing how this control method is applied practically.

German Standards for Phosphatising Steel

Metalloberflaeche, Vol. 4, No. 9, pp. A 137-140.

German Standards DIN 55, 700 are given, covering recommended procedures for phosphatising steel for corrosion protection. Sections covered are fundamental considerations, processes, comprising thick phosphate coating for lacquering, thick phosphate coating for oiling, and thin phosphate coating for lacquering. Methods of operation are then dealt with and surface treatment for phosphatizing. Details of the phosphatizing stage come next, including bath composition and control and charging. Post-treatment and testing recommendations finish off the standard.

Examination of Metal Surfaces by the Lacquer-Print Method

W. Faasch, G. Hein and L. Koch: *Metalloberflaeche*, Vol. 4, No. 9, pp. A 129-135.

The photo-micrographical examination of metal surfaces by reflected light offers many difficulties and when the magnification exceeds 50 the photo-micrographic objective has not sufficient depth to give the required definition. A detailed account is given of the lacquer print method which overcomes this difficulty; a lacquer or plastic impression is taken, which is then examined. The method is of great technical use for the examination of surface finish, in which definition is required to show up the surface irregularities under magnification. Many photo-micrographs are reproduced showing the effect obtained.

Electropolishing of Silver

E. Raub and B. Wullhorst: *Metalloberflaeche*, Vol. 4, No. 6, pp. A 92-94.

The fundamental investigations on the electropolishing of silver were made by the authors in 1941. In this early work, acid baths were used for the electropolishing. The change was subsequently made to the cyanide bath because this allows of satisfying more easily the

fundamental requirement of an electropolishing process, namely the formation of an anodic film. The mechanism of electropolishing of silver in cyanide baths is then dealt with. The potassium cyanide bath is now exclusively used. The current-reversal method is then considered, in which simultaneous silver plating and electropolishing is claimed to take place and it is pointed out why this is not feasible as a commercial process. Higher anodic current densities are necessary than with silver plating. With anodic polishing the cathode surface area must be considerably greater than the anode surface. The working of the bath forms a film of silver cyanide at the anode. The authors found that the electrolyte proposed by Gray, high in silver, was not so suitable as an electrolyte low in silver. The free potassium cyanide and silver contents in the bath are of importance for satisfactory operation. Silver plating baths which contain sulphur or selenium compounds as brightening agents give deposits which electropolish to a finish practically as good as a mechanically polished finish.

Hard Nickel Plating

A Pollack; *Metalloberflaeche*, Vol. 4 (1950) No. 5, pp. B. 54-55.

In the case of hard nickel plating, as also with hard chrome plating, particular attention must be given to a careful pretreatment of the components. Three bath compositions are in use for heavy nickel plate but the Watts bath is not capable of giving hard nickel deposits. The most important bath composition for hard nickel plating comprises in grms/litre, 200 crystalline nickel sulphate, 27 ammonium chloride and 33 boric acid; the brightening agent is $\frac{1}{4}$ g./litre of sodium lauryl sulphate. The plating is conducted at 2.5 to 5 amps/sq. dm.

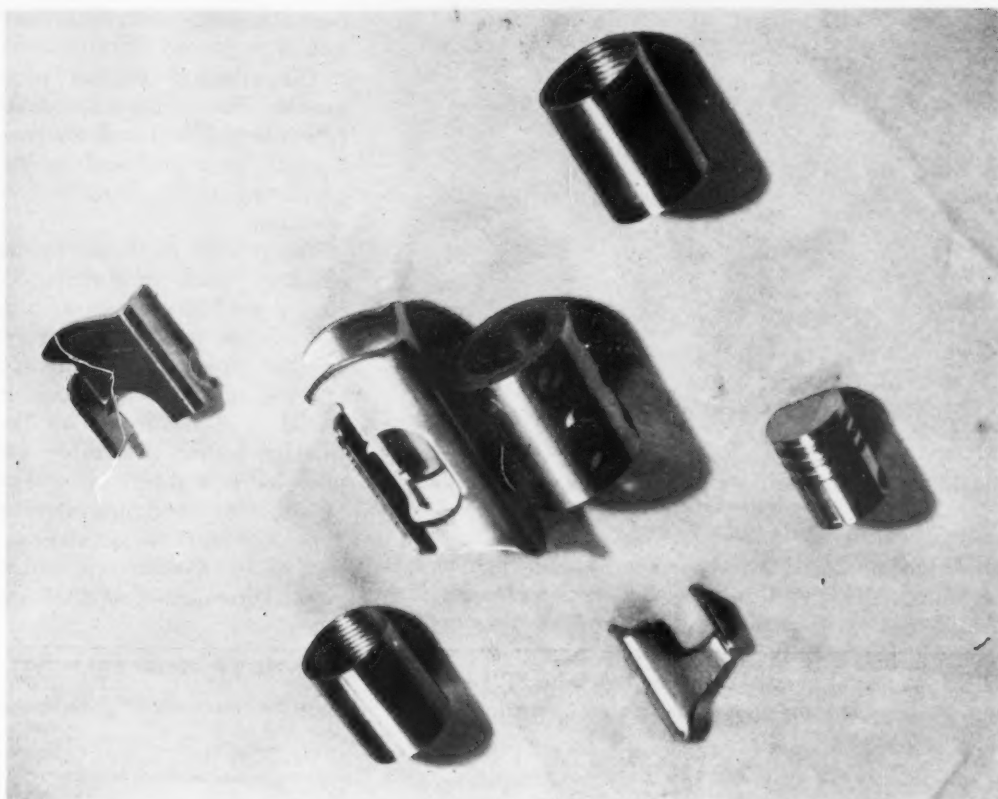
For applications where resistance to chemical attack is of primary importance, such as chemical and food making plant, oil-burner nozzles, etc., hard-nickel coatings are superior to hard-chrome coatings, by virtue of their adhesion properties, their toughness and elasticity and the better plating conditions.

Mechanism of Formation of Aluminum Oxide Coatings

J. Patrie: *L'Aluminum*, No. 162 (1950), pp. 3-7.

The author investigated the influence of the bath temperature on the porosity of oxide coatings. The colder the bath is, the more free from pores is the coating. In addition, the oxidation time influences the porosity. A bath of acid sodium sulphate gives in general the required oxide coatings of lesser porosity. The final treatment of the coating is dependent on the degree of porosity. If the coating is of low porosity, then it is sealed in boiling water or in bichromate. In the first case, the Al_2O_3 is converted into $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ with swelling of the oxide film. With the use of bichromate, the salt particles are absorbed superficially by the film and the chemical resistance of this is improved.

Figure 1. Various small parts chromized by the ONERA method.



Bright Chromizing—The Onera Process

By Phillippe Galmiche, Chem. Eng., Paris, France



Mr. Galmiche is a Chem. Eng. graduate of Paris Univ. He has been with the research dept. of the O.N.E.R.A. since 1947, working under Dr. P. A. Jacquet on magnesium protection and refractory alloys. The method of bright chromizing discussed in this article was developed by him.

THE increasing need of stainless alloys by the chemical and aircraft industries leads to bright prospects for surface diffusion alloys in general. A special interest is attached to alloys made by processes such as chromizing.

Corrosion being a surface reaction, it is often only necessary to modify a minimum thickness of the bulk material by chromium diffusion. This has the double advantage of saving chromium, sometimes up to 95%, and avoiding the machining difficulties met with stainless and high chrome steels. Furthermore, the superficial layer chromium content can reach 50%, conveying corrosion resisting properties which can thus be higher than those of ordinary stainless steels.

The diffusion alloy produced is embodied in the

metal; no layers can peel or scale off in case of thermal or mechanical shock, as could happen in the case of electrolytic plating, whose main advantage is a bright appearance.

Perfectly regular, smooth, and bright layers are obtained in a single operating step, with the new chromizing process developed and patented at the "O.N.E.R.A." (Office National d'Etudes et de Recherches Aeronautiques). These layers are highly resistant to atmospheric or salt corrosion, nitric corrosion, high temperature corrosion and thermal shocks.

Review of Previous Chromizing Processes

Just as with carbon cementation, chromium cementation (chromizing) has been studied in the solid, liquid or gaseous phases.* Chromizing by solid contact with powdered chromium with a diluting body (Kelley process) requires temperatures as high as 1,300-1,400°C., (2372-2552°F.) and produces rough surfaces. Salt bath chromizing (Bergman process) is complicated and costly to set up; it seems that the process never got over the experimental stage. Gaseous chromizing is usually performed by putting the specimens to be treated in a mixture containing chromium chloride, just as in the case of intersolid contact. Chromium chloride

*See also *Revue de Metallurgie*, March 1950, p. 192-200.

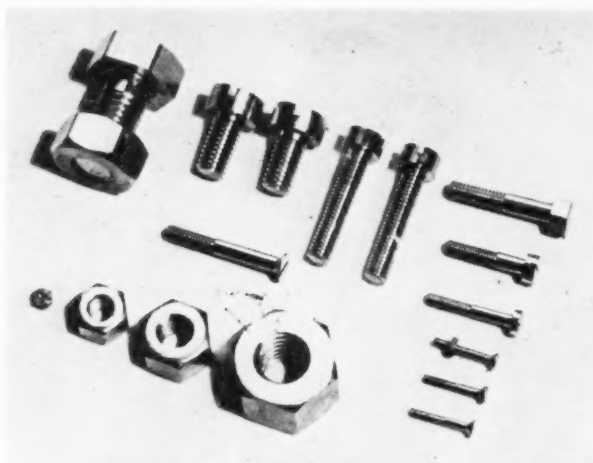


Figure 2. Chromized nuts and bolts for corrosive environments. Note brightness of the finish.

is usually produced by previously sending high temperature hydrogen saturated with gaseous hydrochloric acid into a mixture of chromium and porous porcelain, which retains the resulting chromium compound (BDS process of *Becker, Daves and Steinberg*). Chromium is supplied through an exchange reaction with iron:



It has been also suggested to produce chromium chloride during the chromizing treatment (Marshall process — powdered chromium, alumina and ammonium chloride in the mixture), but the surface of the diffusion layers obtained is rough. A similar process uses chromium iodide (*Diffusion Alloys Ltd.*—ammonium iodide mixture). For all these processes, the working temperature is about 1,050-1,100°C. (1922-2012°F.); a 0.1 mm. (.004") layer (roughly) is obtained after 3 to 4 hours.

The O.N.E.R.A. process is based on catalytic transport of chromium by continuous equilibrium displacement in purely gaseous phase, which leads to perfectly homogeneous and regular layers. They look like the

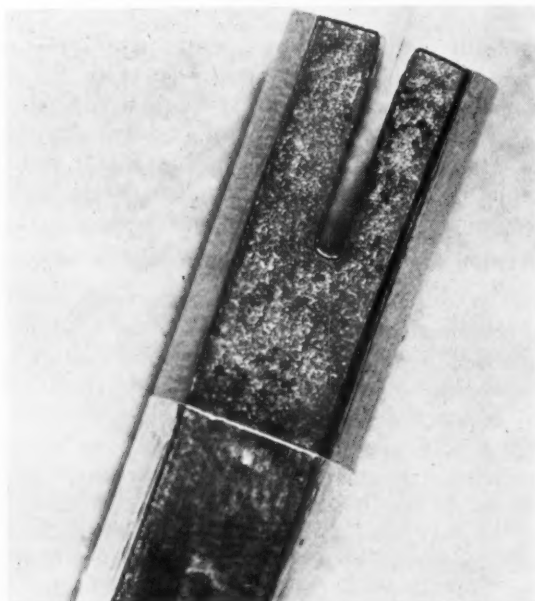


Figure 3. Chromized coating down inside the recess shows the good penetration or "throwing power" of the process.

best decorative electrolytic chromium deposits. (Figs. 1, 2, 3.)

The principle of this process is the chromium fluoride dissociation which takes place as soon as contact is established with the specimens, the chromium fluoride being produced during the treatment and regenerating itself continuously during the course of the operation.

The process is almost as simple to perform as the classical "pack carburizing." The specimens to be treated are laid between a chromium fluoride generating medium and chromium broken into pieces (Fig. 4); the chromium is located for the most part in the upper part of the apparatus or diluted with broken porcelain and surrounding the pieces (Fig. 5), the whole is heated, preferably under a hydrogen atmosphere or in a valve device. The medium is a mixture of powdered chromium, alumina, and moist ammonium fluoride (neutral or acid) or a mixture of ammonium fluoride and hydrofluoric acid.

The chromium is supplied and diffuses in the following way:

Chromium Fluoride Formation

Moist ammonium fluoride or hydrofluoric acid reacts

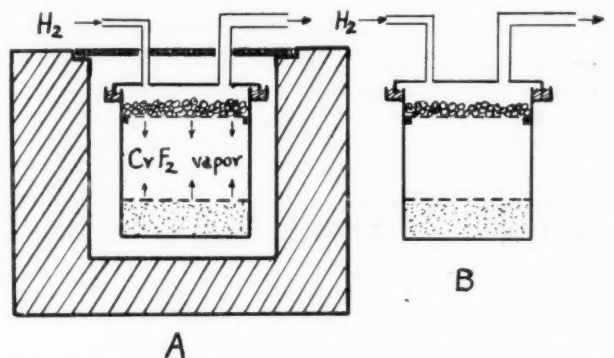


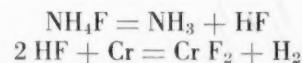
Figure 4. Schematic diagram of the ONERA vapor chromizing apparatus.

in the liquid phase on chromium as temperature reaches 50 to 60°C. as follows:



A strong evolution of ammonia, detected by its characteristic smell, occurs before any ammonium fluoride fumes are noticed.

Temperature being still raised, the last traces of steam are taken away with the volatilized ammonium fluoride excess, which dissociates itself and gives in dry state a complementary amount of chromium fluoride:



Thus a reserve of chromium fluoride is produced and finds itself in a strictly reducing atmosphere.

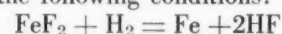
Chromium Supply

Chromium supply starts at about 900° C., when the chromium fluoride vapor tension becomes sufficiently high.

Chromium fluoride vapor reacts on iron:

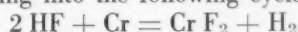


but the iron fluoride thus produced is at once reduced according to the following conditions:



(therefore the specimens do not lose any iron).

Hydrofluoric acid, liberated when arriving in contact with chromium, regenerates stable chromium fluoride thus coming into the following cycle:



Thus, a true gaseous cementation is obtained, with chromiferous gas circulating.

Chromium Diffusion

Chromium brought to the surface of the specimens diffuses according to the classical laws:

$$d = h \sqrt{Dt} \text{ where } D = Ae \frac{Q}{RT}$$

Diffusion is the main factor limiting the layers' thickness. For ferrous metals, the needed temperature lies between 1,050° and 1,100°C. (1922-2012°F.). In case of mild steels, chromium diffuses, producing perfectly ductile solid solution layers, whose useful thickness (range of chromium content greater than 13%) can reach 0.1 mm. (.004") within 3 hours at 1,050°C. and 0.25 mm. (.010") within 6 hours at 1,100°C.

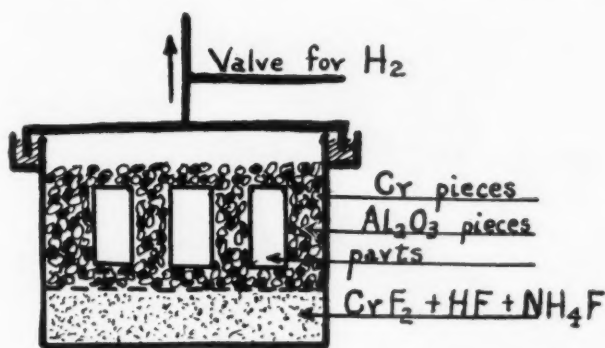


Figure 5. Alternate apparatus for chromizing by semi-contact with the chromizing medium.

(Fig. 6). These layers' average hardness reaches about 200 Vickers. The chromium content as given by spectral analysis and successive electrolytical polishings** exceeds 50% at the external surface and decreases gradually towards the inside (Fig. 7). The occurrence of the iron-chromium sigma phase is sometimes observed down to a very small thickness near the surface; this phase can be eliminated either by a brief electrolytic polishing in the perchloric-acetic Jacquet baths or by a subsequent diffusion treatment without chromium supply. This can be done either during the treatment (reduced quantity of the fluoruous agent) or in a subsequent operation.

For high carbon steels and cast irons, the carbon of the metal is attracted by the chromium diffusing in the reverse direction, thus producing a continuous layer of chromium carbide (Fig. 8) leading to thin (0.03 mm. (.0012") after 4 hours at 1,050°C.) but very hard (800 to 1,000 Vickers) diffusion layers.

In Germany, special steels which contain retaining carbon additions (Titanium, Manganese, Molybdenum) have been prepared for the use of the B.D.S. chromizing process. It has been ascertained that most of the ordinary mild steels give as good results as these special steels with regards to the O.N.E.R.A. process.

In case of very refractory metals such as tungsten

**See also: *Metaux et Corrosion*, mars 1950, p. 65-66.

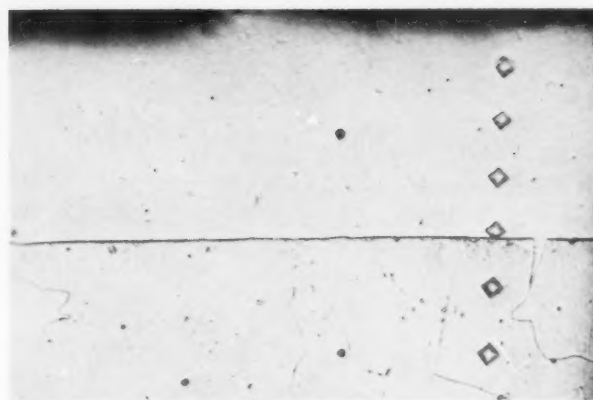


Figure 6. Showing the structure and micro-hardness test penetrations on the chromized layer (top) and the mild steel base. Nital etch.

or molybdenum, the necessary treatment temperature reaches 1,500 to 1,600°C. (2732-2912°F.) the chromium diffusion coefficient being very low in these metals; the apparatus must then be used in a different setting. The very refractory metal powders can be chromized in the gaseous phase between 1,050° and 1,100°C.

In course of use, the chromizing medium does not age; a small quantity of fluoruous compound must be added between each operation. Ammonium chloride is not recommended for this process as the steels can be locally attacked, thus showing some pitting. This attack is probably due to volatile iron chloride produced at the beginning of the process. On the other hand, ammonium fluoride gives a very thin protective layer of iron fluoride, which is not at all volatile and is reduced by hydrogen at high temperature. Furthermore, chromium fluoride has the advantage over chloride of being non-hygroscopic.

Fields of Application

PROTECTION AGAINST ATMOSPHERIC AND SALT CORROSION

The continuous and homogenous chromium diffusion layers obtained by gaseous chromizing are of high value against moist corrosion. Chromized specimens treated for a few hours at 1,050-1,100°C. do not show any pitting due to salt corrosion after several weeks of alternate immersion in artificial sea water.

On the other hand, as regards the decorative value resulting from the chromizing treatment in the gaseous

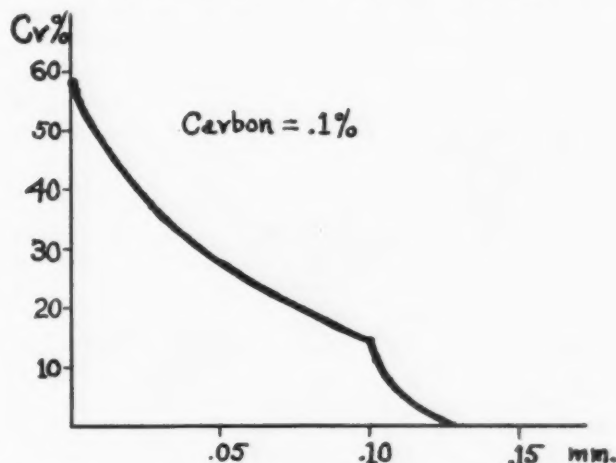


Figure 7. Chromium content vs. depth of penetration on a .1 carbon steel. The coating depth is 0.1 mm (.004").

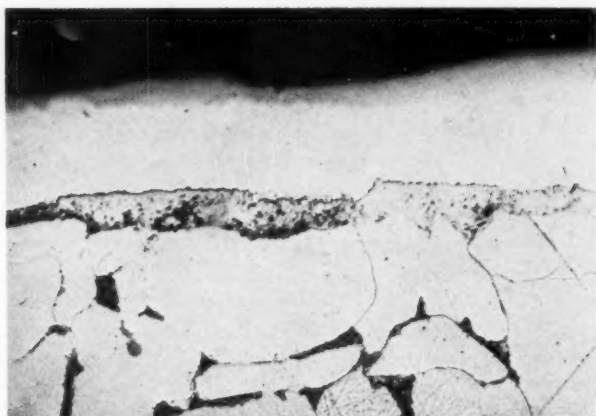


Figure 8. Chromized layer on hard steel. Nital etched. See text for description.

phase, numerous and various applications can be found in the field of motor cars or boat pieces, screws and bolts, etc.

Chromized steel can be electropolished or electroplated with chromium.

Other applications can be expected by considering the corrosion resistance to various organic products, dairy implements, for instance.

WEAR PROTECTION

Chromized layers are highly resistant to wear; this is due to their very good friction and plasticity characteristics; the poor hardness obtained with low-carbon steels can be substantially raised by a complementary nitriding treatment.

The high temperature required by chromizing may cause slight deformations of the specimens being treated; this brings some limitations to the use of the process. The mechanical properties of the metal may also be altered during the process; this may require a subsequent regenerating heat treatment.

PROTECTION AGAINST HIGH TEMPERATURE CORROSION

Both superficial oxidation and chromium diffusion towards the inside brings some limitations to the maximum temperature at which chromized layers can be used. Dry corrosion tests in flue gasses *** show that the life time of homogeneous 0.1 to 0.15 mm. (.004-.006") chromized layers is practically unlimited up to roughly 750°C. (1382°F.). At 800-850°C. (1472-1562°F.), they can be used for several hundred hours, but at 1,000-1,100°C. (1832-2012°F.) the layers vanish after a few hours of heating. In any case the thermal shock resistance is excellent because the physical char-

***See also: *Revue de Metallurgie* 46 (1949), p. 843-848.



Figure 9. Diffusion-coated valve heads. Left—Silchromized; center—alchromized; right—chromized.

acteristics variation is progressive. Chromizing can also be used to protect nickel, cobalt or alloys such as Hastelloy (containing no chromium) against dry oxidation up to about 900°C.

Resistance to dry corrosion can be notably improved by forming mixed diffusion alloys containing, besides chromium, such elements as silicon, aluminum or zirconium. This is done by adding to the medium some of the elements or their compounds. The specimens to be treated are then heated in contact with the medium. Addition products react with the scarcely volatile chromium halide leading to a progressive evolution of the corresponding halides which take part in the gaseous phase cementation. The resulting pieces show a much poorer surface appearance than those treated by gaseous chromizing alone (Fig. 9). Treatment conditions being the same, the thickness of the layers as well as the limiting utilization temperature are notably improved; if, for chromized layers, the limit is 850°C.,



Figure 10. Hollow parts obtained by nitric acid solution of the base metal after chromizing and grinding off one side.

it can be raised to 900-950°C. for the silicon-chromium and to 950-1000°C. for the aluminum-chromium layers.

PROTECTION AGAINST NITRIC ACID AND NITRIC COMPOUNDS

This is particularly useful in the case of the nitric combat rockets, in which several parts may happen to be in contact either with hot concentrated acid or with flue gases containing nitrous vapors.

Resistance against nitric attack in liquid phase is excellent and it is possible, by analogy with electroforming, to obtain hollow pieces of complicated shape by attacking chromized pieces where one side has been taken off by abrasion. (Fig. 10.)

Resistance against attack by nitrous oxides at high temperature is also very good, and regular 0.1-0.15 mm. layers will resist more than 1 hour at 1100°C. to these compounds attack.

IMPROVEMENT OF SOME SINTERED PRODUCTS

Powder metallurgy brings about new developments to gaseous phase chromization. Refractory metal powders are improved by chromization, especially metal-ceramic compounds such as alumina-molybdenum.

Evaluation of Industrial Wastes

In Metal Processing Industries — Part II

By David Milne, Ch.E., General Motors Corp., Detroit, Mich.



This final part of Mr. Milne's article discusses other wastes encountered in industrial manufacturing plants and means for their treatment before disposal.

ELECTROPOLISHING

This operation consists of making the part to be cleaned or polished the anode of an electrical circuit while immersed in a cleaning solution. The solutions used are usually acid in nature with the addition of certain organic materials. Substances which have been used for this purpose include phosphoric, sulfuric, perchloric, chromic, nitric, hydrofluoric, citric and glacial acetic acids, supplemented with acetic anhydride, tartaric acid, glycolic acid, glycerine, carbitol, methyl alcohol, ethylene glycol and many other materials. In most practical applications, however, some combination of phosphoric and sulfuric acids, or mixtures of phosphoric acid and glycerine or carbitol, are used. Some usage of perchloric acid-acetic anhydride mixtures have been reported, but the disastrous consequences of improper control of this process have generally argued against its use.

The disposal of rinse waters from these processes, and of the electropolishing solution itself when spoiled, is generally a problem in acid neutralization. When chromic acid is used, however, simple neutralization is not sufficient, and additional treatment is necessary. (See section under Electroplating—Chromium.) Neutralization of these solutions may be accomplished with waste cleaners, acetylene sludge, or, in the case of dilute rinse waters possibly by the natural alkalinity of the water itself.²⁴

HEAT ENERGY

One of the more commonly overlooked industrial wastes is the great amount of heat energy discharged to sewers and to water courses from various operations requiring cooling equipment.

In many cases these waste waters are uncontaminated, and are readily available for almost any use in the plant other than cooling. It would be necessary to

burn several tons of coal to duplicate the heat energy available from these waters, and consideration should be given to means of recovering the sensible heat in the fluids.

This may be done directly, by use, for instance, as boiler feed water makeup, where the increase in feed water temperature raises the overall efficiency of the system. The water may be used as makeup for processes requiring the use of hot solutions or rinses, or as makeup to scrubbing equipment intended for removal of dusts from atmospheric wastes. Depending on its purity, it may also be retained and distributed as a hot service water supply. Where the nature and volume of the solution indicate the advisability from the economic standpoint, heat exchange equipment may be installed to recover the sensible heat for use in other processes.

OILS, EMULSIFIED

Many manufacturing plants in the metal processing field have occasion to use the oil emulsions more commonly known as "soluble oils." Sometimes it becomes necessary to dispose of these liquids due to combined chemical and physical breakdown, and in some operations, such as quenching of parts undergoing heat treatment, operating factors may require continuous overflow of the emulsion.

These emulsions, which are composed chiefly of mineral and vegetable oils with varying amounts of disinfecting, perfuming, and emulsifying agents, break down on dilution with sewage or natural water, to permit the release of the free oil. This free oil, besides presenting an objectionable oil film on the surface, kills the various forms of life in the watercourses and causes considerable damage and operational difficulty in a sewage treatment plant.

Simple sedimentation will not separate the oils from water in this case, and those treatment methods utilizing baffled tanks will accomplish only the removal of sludges and free oils. Proper treatment of these materials involves the use of chemical feeding, mixing, and settling equipment, and it is frequently found that differences in the types of oil in use will make considerable difference in the method of operation of these devices. In general, it has been found that chemical coagulation by the use of such materials as sulfuric acid, calcium chloride, aluminum sulfate and sodium hy-

droxide have proven satisfactory in the destruction of these oil emulsions.^{9, 13}

Before consideration is given to destruction of these emulsions, however, the possibility of reclaiming the material by proper purification methods should be investigated. It has been found that by suitable chemical treatment and by the application of mechanical purification processes, these emulsions can be preserved for use for a period of years.²³ Since the ultimate in waste control is in the elimination of the waste, any effort made to reclaim the oil emulsion would be a step in the right direction.

OILS, LUBRICATING

These oils are obtained mainly from leakage in lubrication equipment or from leakage in the operation of hydraulic machinery. They are not normally in the emulsified state, and can be separated quite easily by sedimentation. Their objectionable features on disposal to water courses or to sewage treatment plants have been described previously. In general, the installation of retention and settling tanks will suffice for the removal of these materials.^{2, 6} The oil which is removed from the retention tanks by baffling and skimming devices can then be reclaimed for possible use or sale. The presence of oils of this type in the plant waste water is due frequently to carelessness or waste in the plant, and the source of this waste should be tracked down and eliminated.

PICKLING

The various pickling operations used in metal processing plants make use of acids varying in composition with the type of material to be cleaned. For ordinary forging scale the acids used are usually sulfuric or muriatic, and at the time of disposal of these acids considerable amounts of ferrous chloride and ferrous sulfate will be present. Pickling acids are usually considered to be unusable when the concentration of acid drops to between 5 and 10% by weight and the iron concentration rises to 8 or 10 ounces per gallon. Pickling operations on the stainless materials usually make it necessary to use mixtures of sulfuric and muriatic acid, sulfuric acid plus common salt, or in some cases combinations of nitric and hydrofluoric acids. The rinses from these operations will, of course, contain all of the salts and acids found in the more concentrated solutions but in more dilute form.

These wastes can rarely be discharged without some treatment. If the waste is discharged directly to a natural water, the natural alkalinity of the water tends to neutralize the acids in the effluent, and when the solution becomes very nearly neutral in reaction the iron salts present in the solution precipitate out to form sludges noticeable by their color. Discharge of these acids to sewer systems result in deterioration of the sewer structures by acid attack, and to some extent inhibition of the normal sewage treatment processes.

Treatment of the weak rinse waters will depend largely on the quantity of water to be treated. It may be possible to treat by simple dilution, especially if the rinses are discharged to a sewer system served by a municipal sewage treatment plant. Neutralization of the acids in these rinse waters may be necessary if their concentration is high.²⁴ The concentrated waste pick-

ling acid must be neutralized before discharge to sewer systems.^{15, 18, 27} Some municipalities have recently permitted discharge of the neutralized pickle acid directly to the sewer system provided sufficient rinse dilution water is used. It has been found that these neutralized pickle wastes can operate to the advantage of a sewage treatment process provided they are diluted sufficiently so that sludge formations do not interfere with sewer operations. Some investigation has been conducted on the direct use of pickle acids as sewage sludge conditioners in which the pickle acid is transported by tank truck directly to the sewage treatment plant and used as a cheap source of coagulant chemicals.¹² Methods for neutralizing pickle acid must take into account the great volumes of sludge formed during the process. This sludge may turn out to be an even greater problem in waste disposal than the original acid when costs of lagooning space, filtration, handling, transportation, and dumping charges are considered.

Some effort has been made recently to recover the acids from the waste pickle effluent by removing the iron salt and reconcentration of the acids. European operators have paid more attention to this method than have those in the United States, although some steel plants have investigated this possibility, and at least one plant is seriously considering the installation of an acid recovery system.^{20, 21}

POWER HOUSE WASTES

One of the most frequently overlooked sections of a manufacturing plant from the standpoint of industrial waste control is the power house and its accompanying compressor room. The wastes from these sections can contribute some objectionable features to the other materials being discharged from the plant. In general, the materials discharged are relatively easy to control, and their correction from the standpoint of waste disposal should be easily accomplished. The usual wastes experienced from these operations will be as follows:

1. *Boiler Blow Down.* Blowdown from the boilers operating in the powerhouse may be discharged continuously if the boilers are equipped with continuous blowdown facilities, or it may be discharged at infrequent intervals during shift operation. In the case of continuous blowdown a fairly concentrated waste is discharged in small quantities continuously over a long period of time. Where blowdown is accomplished once or twice a shift waste discharge will be high in volume for a relatively short period of time. The predominant features of this waste include the high alkalinity of the water and its high temperature. As discharged from the boiler, the liquid is considerably above atmospheric pressure and at a high temperature. Release of this pressure during the blowdown operation results in the flashing off of large quantities of steam. The remaining water will be discharged at 212°F. Before consideration is given to chemical neutralization of the alkaline quality of the water, a decision should be made as to whether or not it is worth while to recover the flashed steam from the blowdown, and, in addition, the desirability of recovering heat from the blowdown water by means of heat exchangers.

Steam recovery can usually be accomplished quite simply by flashing the blowdown water into a simple tank connected to the low pressure steam line of the powerhouse. The economies resulting from this measure can easily be estimated. Heat exchanger equipment is commercially available for all steps of recovery in this process. If it should be decided that treatment of this waste is desirable, the overall condition of dilution and cooling before discharge to the city sewer should be considered. It is entirely possible that a sufficient quantity of other wastes are being discharged from the plant to dilute the blowdown to an acceptable concentration, and at the same time to lower its temperature. In this case no treatment will be necessary. The blowdown water may also be used as a chemical neutralizing agent for a process discharging an acid waste, or, on the other hand, it may be neutralized if such a step is found necessary, by adding some waste acid or by the addition of acid supplied for that purpose.

2. *Water Softener Sludge.* The sludges obtained from blowing down water softeners usually contain high percentages of calcium carbonate, magnesium hydroxide or calcium phosphate, depending on the process in use. These sludges are relatively harmless as far as stream pollution or sewage treatment plant activities are concerned. They may be objectionable, however, from the fact that their inclusion in the normal plant sewage flow may raise the suspended solids concentration to a figure higher than that permitted by local regulation. In some instances settling tanks are provided to receive the blowdown from these softeners so that the heavy accumulation of sludge may be removed by tank truck for separate disposal. However, the fact should not be overlooked that these materials represent a potential source of alkali for neutralization of acid wastes, and that in some organizations it has been found profitable to pump these slurries to other sections of the plant for use in this type of treatment.

In general, the methods used for disposing of this waste include (a) settling, (b) use as a neutralizing agent for acids, and (c) disposal in cooperation with the local sewage treatment plant, for use as a sewage sludge conditioner.²⁹

3. *Zeolite Softener Wastes.* In regenerating zeolite softeners the common practice is to allow the zeolite mineral to stand in contact with a brine solution for an established period of time, and then to drain the used brine directly to the sewer followed by such wash water as is found necessary. The brine discharged in this way will contain not only sodium chloride but certain quantities of calcium and magnesium chlorides. The only objectionable feature of these wastes is in their high salt content, which may again temporarily raise the total concentration in the sewer outflow to a point higher than that permitted by regulation. Some consideration might be given to making use of this waste as a material for laying dust in the plant area, since it contains the essential ingredients for sodium chloride type

dust preventives. This method may also be applied to the treatment of coal in the coal storage yard. The application of the sodium chloride-calcium chloride solution should help not only in laying dust but in preventing freezing during the winter months. This possibility might also be considered where difficulty is experienced in unloading coal gondolas which have frozen during transportation or in preventing or minimizing freezing in coal and ash hoppers. In general, however, it will be found that the volume of salt solution wasted will far exceed any possible use in these locations, and, where control of the waste is required, a simple retention-dilution system will prove most satisfactory.

4. *Resin Exchange Wastes.* Certain power plants make use of the resin exchange or ion exchange method for treatment of water for their various uses. In the regeneration of these resins certain quantities of fairly concentrated sulfuric acid, sodium hydroxide or sodium carbonate (soda ash) are used, depending on the type of resin being regenerated. The liquid discharged after regeneration of the resins will be composed mainly of sulfuric acid together with calcium, magnesium and sodium sulfates in the case of the action exchangers, and will contain either sodium hydroxide or soda ash together with sodium chloride, sodium sulfate or sodium carbonate in the case of the anionic resins. Frequently both of these resins are used in the same plant, and if regeneration schedules are arranged properly, it may be found convenient to eliminate any trouble from these wastes by interacting the acid with the alkali waste. This may require installation of a holding tank to take care of wastes discharged on an odd cycle. The methods used for neutralization of alkalis and acids discussed previously may be applied.
5. *Acid Cleaning Wastes.* During operation of powerhouse equipment it becomes necessary at times to clean certain equipment which has been exposed to water at high temperatures. Recently there has been a marked tendency to clean these surfaces by means of dilute solutions of inhibited acids such as hydrochloric (muriatic) or sulfuric acids. Additions of other agents such as ammonium bifluoride are often encountered to take care of specific scale ingredients, and in the case of heat exchange surfaces which have become coated with oily residues, alkaline materials or certain organic dispersing or dissolving agents may be used. Following completion of the cleaning cycle, the common practice has been to discharge these wastes directly to the sewer. Since the acid waste still contains between 1 and 2% of free acid, there is every possibility that some destruction of sewer systems will take place in the neighborhood of the powerhouse. To prevent this possibility some arrangement should be made to add lime or soda ash or some other alkaline material to the waste acid as it is being discharged. Some consideration has been given to circulating these wastes through softener equipment, feed lines and filters, in an attempt to reduce the concentration

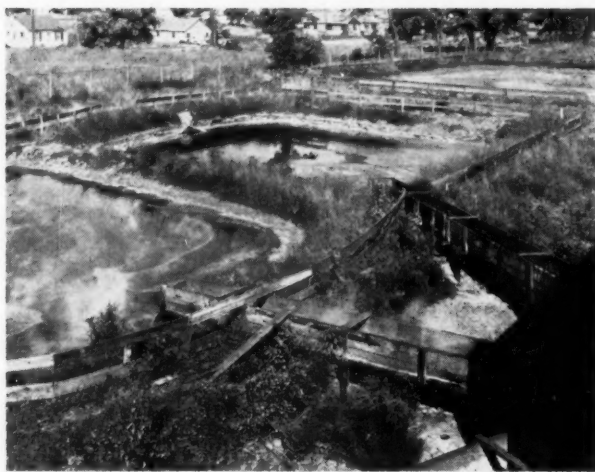


Figure 3. Lagoons at Oldsmobile Forge Plant to receive pickling waste sludge after neutralization. Two lagoons in foreground are being filled, while lagoon in background is permitted to dry.

of this waste acid by reaction with the scale in these pieces of equipment. This may prove an unsatisfactory procedure due to the possibility of clogging the filter material with metallic hydroxides removed from other portions of the system, and also to the possibility of breaking large pieces of scale from the walls of the feed lines. This latter effect could produce a considerable amount of trouble by lodging of particles of this scale under the operating sections of control equipment such as Copes Regulator valves. Simple methods of neutralization of the waste acids outside of power house equipment should be more satisfactory. Where non-acid cleaning agents are used, including the organic fluids, special arrangements should be made to determine the degree of pollution which might result from their discharge. Where these methods of cleaning are under the supervision of outside contractors, the situation with regard to waste disposal should be discussed at the time of contract negotiation.

6. *Oil Drips.* General powerhouse operation, and in particular the operation of compressor rooms, results in the loss of certain quantities of lubricating oil. This oil may be lost down floor drains or it may be discharged from steam traps operating on separators installed in the exhaust steam lines from compressing equipment. The oil from these sources may be either a floating oil or it may be very thoroughly emulsified in water. The emulsified oils are obtained particularly from compressor exhaust. Control of these wastes will include conducting the drippings and trap discharges to catch basins with skimming equipment, filtration of the entire discharge through coke beds which may then be burned or simply by spraying the wastes on the coal pile. If large quantities of oil are recovered from the surfaces of the catch basins some resale value might be obtained, or, where it is impossible to sell the material for salvage, the oil may be burned by means of simple equipment in the boiler furnaces.

SALT BATHS

The possibility of toxic waste products resulting from the operation of molten salt baths should be considered. Where salt baths are operated as carburizing or nitriding units, and where water is used as a quenching or washing medium, the effluent from this process will contain a considerable amount of cyanide. In general, the salts used for carburizing and nitriding are combinations of sodium cyanide, potassium cyanide, barium chloride and other minor ingredients. The solutions resulting from washing parts which have been treated by these baths will be alkaline in character and will contain significant amounts of barium and cyanide. The barium in the solution will generally precipitate as the carbonate or sulfate and will not represent a great pollution hazard. The cyanides, however, must be removed by proper treatment methods. (See Cleaning — Cyanide Dips.)

SPRAY BOOTHS

The solutions used to maintain the surfaces of wet-type spray booths in a clean condition may also be considered as potential sources of pollution. In normal operation a slight amount of overflow of solution may be permitted, and routine cleaning of the booths may involve dumping the solution at intervals depending on the production load. As originally made up, these solutions are usually strongly alkaline in character, and, in fact, the compounds from which they are made are usually based on alkali cleaner formulations. During operation, however, a large quantity of solid matter is introduced to the solution both from the paint and from various other sources such as dry well compounds, dirt, and general shop rubbish.

The solid matter in these solutions should be removed by settling and skimming, and the liquid allowed to bleed slowly into the general plant sewer flow. If conditions are such that this method of disposal will result in excessive concentrations of alkali in the sewer, then some method of neutralization with acid will have to be used. The strongly alkaline nature of this material, together with its high solid content, would make it desirable for use as an acid neutralizer in a central waste treatment plant.

SURFACE CONVERSION TREATMENTS

The surface conversion treatments include various rust-proofing processes and the cleaning operations connected with them prior to the actual rust-proofing. The cleaners have been discussed previously and will not be included in this section. The usual rust-proofing or surface conversion treatment encountered in automotive manufacturing includes the phosphate treatments and the anodic treatments of aluminum. In the phosphate treatments certain quantities of iron, zinc and manganese phosphates are lost in the rinse effluents, and successful operation of the system requires the discharge and replacement of chromic acid solutions at regular intervals. The metallic phosphates will usually precipitate from solution during the dilution and will prove to be of no great concern from the standpoint of pollution. The chromic acid, however, has been proven injurious as previously noted, and where large quantities of solution are wasted, should be

treated by reduction to the chromic form. Concentration of chromic acid from these wastes is usually relatively low, and it is frequently possible to dilute this material with the other plant wastes to a concentration low enough to prevent any toxic reaction. This can usually be accomplished by discharging to a retention tank, then permitting a small controlled flow to the main plant sewer.

Solutions used for anodic treatment of aluminum must be discarded at intervals due to contamination from various sources. These intervals will, of course, depend almost entirely on the amount of work being processed and the care and cleanliness exercised at each preceding step in the treatment procedure. When discharged, each solution will contain quantities of aluminum salts plus other indeterminate impurities which will vary in character and concentration with each application. The various processes in use for anodic oxidation make use of a number of different solutions together with some considerable variation in concentration. Some of the solutions in use include sulfuric, sulfuric-oxalic, oxalic, sulfamic, chromic, boric and phosphoric acids. Dilute solutions of sodium hydroxide (caustic soda) are frequently used for etching prior to anodic treatment, and, where dyeing of the anodic film is practiced, a sealing solution containing from 2 to 3% nickel acetate may be used. In most plants, however, anodic treatment for corrosion resistance is performed in sulfuric, sulfuric-oxalic, or chromic acid solutions, the concentrations of each being from 5 to 15% acid by weight. Anodic treatment to provide a base for plating on aluminum may be performed in a solution containing from 20 to 50% phosphoric acid.

When dumping of sulfuric, sulfuric-oxalic, or phosphoric acids becomes necessary the concentrated acids should be discharged to a retention tank, from which they may be trickled slowly to the general plant sewer flow or treated with alkaline materials as found necessary. Solutions containing chromic acid require much more consideration in disposal, due to the toxic nature of the chromate involved, and the specific treatments recommended for chromate reduction should be used. (See Electroplating — Chromium.) Under normal conditions the nickel acetate sealing solution or the dye solutions will require replacing only at long intervals. If such replacement becomes necessary the solutions may usually be discharged from retention tanks into the main sewer flow without treatment, provided the discharge is limited to a low flow for a considerable period of time. Rinses from these systems will rarely require special treatment.

WET SAND DECK OPERATIONS

In the operation of a wet sanding system for painted components a considerable amount of wash water flows over the structure being sanded and removes the particles of solid matter dislodged by the sanding operation. The effluent from these wet sanding operations will contain varying quantities of solid matter, a typical analysis being about 300 ppm suspended solids on the average. This amount of suspended solids is not generally considered injurious nor is the character of the solid matter suspended in the water of any hazard. In locations where water supply is critical

there is no reason why this wet sand deck water could not be collected in settling reservoirs and recirculated for use in service water systems. If this step is contemplated, it must be made absolutely certain that the water is not used for human consumption since it has been exposed to contamination during its initial use.

MISCELLANEOUS

In general metal processing plant operation there are certain miscellaneous wastes which are disposed of at frequent intervals but which represent a source of potential contamination, either of streams or sewers or of the atmosphere. In general, these wastes will include such material as used and dirty paint thinners, rejected paint, rejected hydraulic oils and used automotive oils. Some of these materials may possibly be used for laying dust on roads and parking areas and some attempt has been made in the past to dispose of the oils by incineration. Normally, open burning of these oils will result in the formation of dense clouds of highly objectionable smoke, and for this reason open burning is usually discouraged. Properly constructed incinerating equipment can usually take care of these materials; however, it has been found practical in some cases to install small nozzle burners in the walls of powerhouse furnaces for disposal of these items. By use of simple pumping equipment the amount of wastes of this nature obtained from normal plant activity can usually be handled successfully by burning under the boilers. If consideration is given to disposal of these oils on parking lots, it should be remembered that the runoff from these areas after a rainfall will carry certain amounts of the oils into the sewers. The quantities lost in this way may be objectionable to the local stream control authorities. In the case of large areas, such as extremely large parking lots, there is little doubt that eventually some restriction will be made on the use of oil as a dust preventive. In that case the only recourse for disposal of these materials is by incineration as outlined above.

Summary

The various waste solutions resulting from operation of a comprehensive metal processing plant have been

(Concluded on page 71)



Figure 4. Gravity type oil separator system in use at Oldsmobile Forge Plant, General Motors Corp. This arrangement is satisfactory for recovery of floating oil, but would require additional equipment for treatment of emulsified oils.



Industrial Mobilization of the Job Plating Industry

By Will Zinn, *Pres. of National Ass'n. of Metal Finishers*

IN 1946, as a result of electro-plating problems that had to be worked out in World War II, the *National Association of Metal Finishers* was organized and incorporated, made up of members who were local job-plating organizations in the various plating centers throughout the United States. Impetus for the organization was furnished largely by New England, New York, Detroit, San Francisco, St. Louis, and Chicago local associations.

From 1946 through 1949 the National Association of Metal Finishers went through the "growing pains" of interchanging management data, publishing its monthly plating news, publishing a National Directory, publishing a metal finishing manual, and devoting its energies to the carrying out of projects intended to improve the lot of the job shop electroplating operator.

With war clouds on the horizon in 1950, the NAMF was drawn forcefully into the problem of mobilization of the electroplating industry.

Unexplained and unforeseen shortages of cadmium, nickel, nickel salts, zinc, copper and other materials used by the electroplating industry were made the first order of business and committees were set up in various parts of the United States to study the shortages and make recommendations to the membership.

Hardship formulas were prepared for use by those plants who were caught without operating materials and would have to present their case to suppliers and request special assistance in order to stay in operation.

The Executive Secretary of the NAMF, *Mr. Raymond Shock*, whose offices are at 2236 Dime Building in Detroit, was deluged with mail, telephone calls and requests for assistance from our various members.

Committees were dispatched to the offices of the principal supplier of nickel in the United States, *International Nickel Co.*, of New York City, to see what could be done in the way of securing information on the availability of nickel so that our plating shops would know how to plan their production.

Other members went on to Washington to discuss the reopening of idle facilities in the development of new sources of scarce materials through the offices of the Department of the Interior and the Bureau of Mines, and by contacting various Consulates representing foreign countries where supplies might be available.

I made it a point to be with a number of these committees in order to get first-hand information that could be coordinated into a program intended to help our job shops remain on a secure operating basis,

especially during the transition period from a civilian economy to a mixed defense and civilian economy.

During the month of August, meetings of local associations throughout the United States were devoted largely to conservation measures because no supplies were available, and the likelihood is that these conservation measures, when instituted, will remain a part of Standard Practice in job shops throughout the United States.

Early in September and continuing through the month, concentration has been centered on endeavoring to determine the needs, requirements and policies of the Federal Government with regard to restrictions, controls, price regulations, wage regulations, and other economic and defense measures that would affect the general civilian economy and, of course, the job plating business.

The National Association offered to assist in the setting up of priorities and regulations affecting our industry, both in that they would supply data on the capacity and ability of their members to contribute to the defense effort and they would supply information as to the relative value of the services performed in the electroplating industry to the civilian economy.

Now that we are assured of control through the Department of Commerce on allocations and priorities, we will continue to keep in close touch with the Department and offer such assistance as they may require so as to keep the cost of government at a minimum insofar as the new control program is concerned, and also to make available to the Department of Commerce full information on the use of strategic materials in the civilian economy in order to help them intelligently carry out an allocation and priority program.

Raising our eyes above the workshop in our individual plants to the greater problem of the defense of our homeland, we can see the need for statesmanship in public office and statesmanship at industry level, which means personal and financial sacrifice on the part of businessmen in that we must devote our energies more directly to helping lead our nation toward a stable, efficient, high level of production and equitable distribution of the wealth created.

We, as industry leaders, have a moral obligation to undo the very serious harm that has been introduced into our industrial machine through policies of labor organizations and government that have resulted in removing incentive for many workmen, encouraging pay for no work, encouraging people to depend on government for their food, shelter and livelihood, reducing the incentive to go into business, to continue in business, or to expand business because the price a businessman has to pay is getting so high in

demands on his personal energy that there is a trend away from the very expansion and opening of new businesses that has been largely responsible for the steady increase in the standards of living in these United States.

There is no business organization that comes anywhere near to exercising the economic control now resting in the hands of some of the labor leaders who, through interlocking union connections, can almost at will paralyze the entire nation, jeopardize every living person's health, stop completely any defense program that might be in the making, raise the cost of living by arbitrary wage demands, and attempt to secure pensions and other security on a basis that is not financially, actuarially, or economically sound.

Since government has not discouraged this trend of power into the hands of a few, the only potential offsetting influence is that of industry leaders, and to date they have not formed any kind of organization that can function to have any appreciable influence in counteracting the national emergencies that are created through industry-wide and nation-wide strikes.

We cannot sit idly by, content with protecting our own little individual personal company interests while a great, uncontrollable power continues to grow in the hands of a few labor leaders. We are not engaging in an anti-labor program, but we must come to the defense of the United States by reducing the power that can be wielded by any one or any few men.

The United States is a nation of action. Its people are at their best when they are breaking production records, making something new, making an old job easier or faster, cutting costs, and spreading distribution. In fact, our strongest characteristics are those most needed to get us out of the peril we are in or will be in until we have the defense force and machines to match the best that can be thrown at us. All we need now is the inspiration and leadership to permit these characteristics to come into full play. Let no man feel content to wait for the other fellow to start the ball rolling. Every one of us has a personal stake in the outcome of this dilemma, therefore every one of us should and must use every ability, every idea, every opportunity to contribute toward the achievement of national security and world peace.

EVALUATION OF INDUSTRIAL WASTE

(Concluded from page 69)

examined for their possible effect on water pollution and sewage plant activity. Methods for prevention of loss from these wastes are discussed, together with suggestions for treating the undesirable wastes. No detail is given on methods of treatment, but reference is made to literature describing the processes to be used. While it is not claimed that all solutions contributing to the pollution problem in the metal processing plant have been covered in this discussion, it is believed that the information put forward will serve to establish the position of the usual plant with respect to possible pollution. The need for further investigation will be established by checking operations in the plant against those described, and plant management will be in a much better position to discuss pollution abatement with enforcement authorities.

References

1. Barnes, G. E., "Treatment Works for Plating Wastes Containing Toxic Metals and Cyanides," *Water & Sewage Works*, **94** (1947), 267.
2. Barr, B. A., "Reclamation of Oil in a Large Industry," presented at the *Fourth Industrial Waste Conference*, Purdue University, Sept. 1948.
3. Bleiweis, J. L., "Plating Waste Disposal," *Iron Age*, **163** (1919), No. 4, 78.
4. Burley, F. H., "Carbide Lime Slurry for Sludge Conditioning — A Discussion," *Sewage Works Journal*, **19**, No. 5, (1947), 801.
5. Burley, F. H., "Vacuum Sludge Filtration Practice at the Detroit Sewage Treatment Plant," *Sewage Works Journal*, **20**, No. 5 (1948), 899.
6. Burroughs, L. C., "Disposal of Refinery Wastes," *Petroleum Refiner*, **25** (1946), 299.
7. Dobson, J. G., "Disposal of Cyanide Wastes," *Metal Finishing*, **45**, (1947), No. 2, 78; **45** (1947), No. 3, 68.
8. Eldridge, E. F., "The Removal of Cyanide from Plating Room Wastes," *Bull. No. 52, Mich. Engineering Experiment Station*, East Lansing, Michigan 1933.
9. Eldridge, E. F., and Purdy, R. W., "Treatment and Disposal of Waste Soluble Oils," *Sewage Works Journal*, **20** (1948), 849.
10. Fales, A. L., "Plating Waste Disposal Problem," *Sewage Works Journal* **20** (1948), 857.
11. Farrell, J. F., "Pickling vs. Grit Blasting for Cleaning," *Metal Finishing* **42** (1949), No. 2, 69.
12. Groen, M. A., "The Use of Steel Pickling Liquors for Sewage Sludge Conditioning," *Sewage Works Journal* **21** (1949), 1037.
13. Haseltine, T. R., "Character and Treatment of Soluble Oil Wastes," *Sewage Works Journal*, **21** (1949), 859.
14. Herda, N., "Treatment of Cyanide and Acid Plating Wastes," *Sewage Works Journal* **18**, No. 3, 499.
15. Hoak, R. D. and Sindlinger, C. J., "New Technique of Pickle Liquor Neutralization," *Ind. & Eng. Chem.*, **41** (1949), 65.
16. Hoover, C. R., and Masselli, J. W., "Disposal of Waste Liquors from Chromium Plating," *Ind. & Eng. Chem.*, **33** (1941), 131.
17. Kominek, E. G., "Treatment of Plating Wastes," *Metal Finishing*, **47** (1949), No. 3, 56.
18. Kraiker, H., "Disposal of Pickle Liquor at a Profit," *Chem. Eng.*, **56** (1949), No. 3, 112, 144.
19. Leonhard, H. M., "Carbide Lime Slurry for Sludge Conditioning," *Sewage Works Journal*, **19** (1947), 796.
20. Martin E. D., "Continuous Strip Pickling," *Blast Furnace and Steel Plant*, **36** (1948), No. 7, 825; No. 8, 942; No. 9, 1089.
21. Ornsen, G. M., "Treatment of Spent Pickling Liquors Containing Sulfuric Acid and Iron Sulfate," *FIAT Final Report No. 1117, Office of the Publication Board, Dept. of Commerce, Washington, D. C.*, June, 1947.
22. Oyler, R. W., "Disposal of Waste Cyanides by Electrolytic Oxidation," *Plating* **36** (1949), No. 4, 341.
23. Pratt, M. A., "Extended Use of Oil Emulsions to Minimize Disposal Problems," presented before the Michigan Sewage Works Association, May, 1949, and published in March, 1950, issue of *Sewage Works Journal*.
24. Reidl, A. L., "Limestone Used to Neutralize Acid Wastes," *Chem. Eng.* **54** (1947), No. 7, 100.
25. Southgate, B. A., "Recovery of Copper from Waste Waters," *The Industrial Chemist*, **21** (1945), 144.
26. Sperry, L. B., and Caldwell, M. R., "Destruction of Cyanide Copper Solutions by Hot Electrolysis," *Plating*, **36** (1949), No. 4, 343.
27. Unwin, H. D., "Treating Metal Working Wastes," *Eng. N.R.*, **141** (1948), No. 8, 91.
28. Weischhaus, L. J., "Cleaning Forgings," *Metal Prog.*, **56** (1949) 496.
29. Williamson, J., "Water Plant Lime Waste Used for Sewage Coagulation," *Public Works*, **89** (1949), No. 4, 29.
30. Wischmeyer, W. J., and Chapman, J. T., "A Study of the Effect of Nickel on Sludge Digestion," *Sewage Works J.*, **19** (1947), 790.



The E.T.S. was accorded a civic reception by the Burgomaster at The Hague. Picture shows the Burgomaster seated with Executive Officers of the E.T.S.—Mr. A. W. Wallbank, Pres.; Dr. S. Wernick, Secy.; Mr. F. L. James, Treas. The Dutch Studiekering Galvanotechniek was represented by Dr. Odekerken, Secy.

Electrodepositors Technical Society Holds Conference on Electrodeposition in Holland

A VERY interesting meeting took place recently at The Hague, Holland, when the British Electrodepositors' Technical Society held a conference in conjunction with the new Dutch Electroplaters' Society, which was formed just over a year ago. The E.T.S. have a special interest in the new society, in that it was formed by a number of Dutch members of the older society and undoubtedly its inspiration resulted very largely from the well-known activities of the E.T.S.

The Dutch Society, which goes under the name of the Studiekering Galvanotechniek, is in turn a branch of the Bond Voor Materialenkennis Kring Metalen, which is the equivalent of the A.S.T.M. of this country.

The number of British delegates exceeded thirty, two parties crossing to Holland, one by sea and the other by air, meeting their Dutch opposite members at the Kurhaus Hotel, Scheveningen, for dinner on the evening of September 27th. Among those present were the President of the E.T.S., Mr. A. W. Wallbank, the honorary Secretary, Dr. S. Wernick, and the Honorary Treasurer, Mr. F. L. James. The executive officers of the Dutch society who were present were the Chairman, Dr. Hoekstra, and the Honorary Secretary, Dr. Odekerken.

The following day, the E.T.S. were accorded a civic reception by the Burgomaster of the Hague at the Town Hall. The Burgomaster made it clear that the visitors were very welcome, and there was no doubt from the hospitality showered on the party that the

atmosphere was one of overwhelming goodwill. After the official lunch, the conference opened with two papers by Mr. De Bruyn (Holland) and Dr. Cuthbertson (Great Britain) respectively. The subjects were as follows:

Mr. De Bruyn—"Throwing Power and Covering Power in Electroplating Solutions"

Dr. Cuthbertson—"Recent Developments in Tin and Tin Alloy Plating."

The proceedings throughout were in English, and the Dutch participants in the discussion showed an admirable command of the English language.

The number of delegates present at the conference meetings reached a figure not far short of 100, indicating the interest taken by both countries in the proceedings.

On the following day, members of the conference entrained for Eindhoven, which is the headquarters of the giant Phillips concern. There they were able to inspect, in particular, a new metal finishing department which has been only recently installed. British visitors found the methods and processes in use in these works of considerable interest in comparison with British practice. A second technical session of the conference took place in the Lecture Room of the works, and at this session the following papers were read:

Dr. P. Baeyens: "Modern Technique and the Electrolyte"

Mr. R. van Rossum: "Plating Rectifiers"

Dr. A. Claassen: "Electrical Measuring Instruments for Electroplating."

There was also a most interesting exhibition of electrical equipment of all the most modern types manufactured by the Phillips Company, which was open to inspection for the visitors. The delegates then returned to The Hague for the official conference dinner.

The following day was spent in sightseeing, visitors being taken by bus to Amsterdam, and there a most pleasant and interesting trip was made by motor boat through the canals of the city. A visit was also made to Volendam, where many of the Dutch folk still dress in typical native costume.

The social aspects of the conference were in no way overlooked, and all the foreign delegates thoroughly enjoyed their stay, as well as finding the technical proceedings most interesting and instructive.

Holland is to be thoroughly congratulated in this first effort at organizing a conference dealing exclusively with metal finishing subjects, and the E.T.S. may well be proud of their share not only in the proceedings of the conference but in inspiring the inception of the new society.

An abstract of one of the most interesting papers presented at the conference, that by Dr. Cuthbertson, is appended below:

Recent Developments in Tin and Tin Alloy Plating

ELECTRODEPOSITION OF TIN

All plating solutions fall naturally into two categories, alkaline or acid.

The only practicable alkaline baths so far developed are of the stannate type. In these baths, tin is present as Sn^{IV} , in the acid baths as Sn^{II} . The chief disadvantage of the sodium stannate bath is its limited cathode current density range. The potassium stannate bath has a higher conductivity than the corresponding sodium bath and can be operated at much higher cathode current densities.

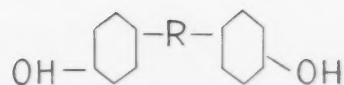
There are a number of possible acid tin baths and several of these have been brought to a high state of perfection.

In large installations the stannous sulphate-cresol-sulphonic acid bath has now been completely superseded by the stannous sulphate-phenol-sulphonic acid bath. This substitution has markedly cheapened the electrolyte and has eliminated certain complications connected with the use of cresol-sulphonic acid.

One of the most successful tin plating solutions introduced in recent years is the so-called "halogen" bath, invented and patented by *E. I. Du Pont de Nemours and Co.* It contains stannous chloride and a fluoride of an alkaline metal (including ammonia).

Another tin plating bath is the stannous fluoborate bath, but a problem with the straight tin bath is the sludging of the electrolyte and anodes.

All acid solutions, except aqueous stannic chloride, require an addition agent. Previously the addition agents used in the stannate sulphate bath were glue and B-naphthol, but recently excellent results have been obtained in the stannous sulphate and stannous fluoborate bath by use of compounds having the structural formula:



e.g., dihydroxyphenylsulfone, in which $\text{R} = \text{SO}_2$ or dihydroxyphenylmethane, in which $\text{R} = \text{CH}_2$.

HIGH-SPEED ELECTRODEPOSITION OF TIN

When the cathode is moving rapidly with respect to the electrolyte a substantial increase in cathode current density becomes possible, and with the more highly conducting acid solutions a current density of 400 amp. per sq. ft. is quite practicable and 1000 amp. per sq. ft. may not be impossible in the near future.

DEPOSITION OF TIN ALLOYS

The co-deposition of two or more metals is more difficult than the deposition of a single metal.

One of the most important factors contributing to the success of alloy plating is close analytical control of the plating bath, and with proper control many of the difficulties of the process disappear.

Speculum. Structurally the deposit is intermetallic compound in nature, and in composition corresponds fairly closely to the composition Cu_3Sn .

Tin-Zinc. The optimum composition is around 75% tin and 25% zinc. Plate of this composition is very resistant to corrosion and affords excellent protection of steel.

Tin-Lead. Tin and lead are usually co-deposited from a mixed fluoborate bath.

Ternary Alloys. Exact control of the composition of the deposit in ternary alloy plating is extremely difficult.

The paper ended with a review of future prospects and the trend of research.

METAL CLEANING

(Concluded from page 57)

foot. Pre-cleaning to remove heavy accumulations of dirt is advisable in electro-cleaning and usually cuts the cost of electro-cleaning.

Acid Cleaners

Cleaners of the acid type are used to remove oxides, scale or traces of alkaline materials. The surface required by the electroplating and other finishes must be free of all oxides. Preparation of such a surface can be accomplished by an acid dip after the alkaline cleaner has removed the dirt and oil. Hydrochloric or sulphuric acids are the most commonly used for ferrous metals. Combinations of sulphuric, nitric, hydrochloric, hydrofluoric, chromic, and certain inorganic salts are used on non-ferrous metals for cleaning and brightening.

Last, but by no means least, is the rinsing. Good rinsing, either by dip or spray, is the answer to all good cleaning. The rinse water should be kept constantly changing. There have been many instances where a cleaner has been blamed for inferior cleaning where a contaminated rinse tank was the actual cause of the trouble.

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Hard Chrome Plating to Final Size

Question: We are hard chrome plating some parts with .020" of hard chrome, about .005" of which we later grind off to finish size these parts. The parts are cylinders about 3 ft. long and 4" in diameter. We have heard that it is possible to chrome plate to finished size, thus eliminating the final grinding operations, and would like to know if this would be possible in our case?

P. A. R.

Answer: Whether or not plating to final size can be done depends on the shape of the part, the thickness of metal deposited, and the final tolerances allowed on the dimensions. For deposits as heavy as .020" it is doubtful if this is feasible. It is possible, of course, to reduce the amount of final grinding required by paying attention

to all details which result in uniform plate thicknesses, such as auxiliary anodes, current thieves, cathode rotation, etc. Most hard chrome plated parts are for engineering applications where close tolerances are required, often in the order of a few ten-thousandths, which is difficult to maintain in heavy chrome plating, such as this.

Alloy Gold Color Control

Question: I am plating a pink gold on stainless steel watch bands. The bath contains copper and nickel, as well as the gold. When I flash the work in a new bath I get a nice light pink color, but after a few weeks the color changes to a brownish shade. I would appreciate it if you could point out what may be causing this.

S. F.

Answer: The common problem on all gold alloy plating baths is keeping

the metals in balance. We suggest that you have the bath completely analyzed to see that the various constituents are up to the original specifications. After this a regular analysis, as often as once a day, should be made to keep the bath from getting too far out of limits.

Immersion Cadmium Plating

Question: We recently ran across a patent reference (Patent 2,272,777) for a bath consisting of cadmium oxide, caustic soda, and water, used at 125°C. that will deposit a film of cadmium on steel. Is there any danger of exploding this mixture when heating it to this temp.? What kind of a vessel would be best for holding the mixture?

G. E. B.

Answer: We would like to point out that Patent 2,272,777 was granted in 1942, and therefore is still in effect, so that you would have to obtain permission to use this formula.

An ordinary steel tank or pail would be satisfactory. Do not use a galvanized or porcelain enameled container. There should be no danger in heating such a mixture to 125°C.

PROFESSIONAL DIRECTORY

JOSEPH B. KUSHNER, Ch. E.

Headquarters of
"ELECTROPLATING KNOW HOW"
STROUDSBURG 3, PENNA.

SCIENTIFIC CONTROL LABORATORIES

Finishing Consultants—Registered Engineers
Salt Spray—Thickness Testing—Analyses
PLANNING—RESEARCH—DEVELOPMENT
HAYmarket 1-2260
600 BLUE ISLAND AVE., CHICAGO 7, ILL.

HENRY LEVINE & SON, Inc. Metal Finishing Consultants

Analysis of all electroplating solutions
Engineering of metal finishing installations
Complete service for metal finishing plants
153 East 26th St., New York, N. Y.
MURray Hill 5-9427

"ELECTROCHEMICAL TECHNOLOGY" E. J. HINTERLEITNER AND ASSOCIATED ENGINEERS

669 Summit Ave., Westfield, New Jersey
Phone: Westfield 2-4766

Comprehensive Consulting Service for ALL Metal-Finishing Problems
Complete Systems and Installations prepared for ALL MODERN PROCESSES

FOR: Aluminum and Magnesium Treatments Plating on Aluminum
FOR: ELECTROPOLISHING (Co-Originator of First American processes)
FOR: Newest "Filling" Highspeed Nickel
FOR: ALL HIGH SPEED BRIGHT, SEMI-BRIGHT Plating Processes (acid, alkaline)
FOR: Highspeed SILVER and GOLD Plating INDIUM PLATING, etc.
CONTINUED: NEXT MONTH

G. B. HOGABOOM JR. & CO. Consulting Chemical Engineers

Metal Finishing — Electrodeposition — Solution analyses. AIR FORCE CERTIFICATION TESTS — Salt spray, thickness of deposits, adhesion.

44 East Kinney St. Newark 2, N. J.
Market 3-0055

PLATERS TECHNICAL SERVICE, INC.

ELECTROPLATING AND CHEMICAL ENGINEERS

Spectrographic & Wet Analyses—Metals, Alloys, Solutions — Plant Layout — Design — Construction — Industrial Plants — Industrial Waste and Water Supply Treatment.

New York Laboratory
59 East 4th St. New York 3
ORegon 3-6256
Chicago Laboratory
509 S. Wabash Ave. Chicago 5
HARRison 7-7648

S

st that
alyzed
nts are
After
ten as
o keep
out of

ting

cross a
(7) for
oxide,
125°C.
mium
of ex-
ting it
vessel
xture?
E. B.

int out
ated in
effect.
in per-

would
galvan-
tainer.
heating

CO.
ers
- Solu-
ATION
eposits,
2, N. J.

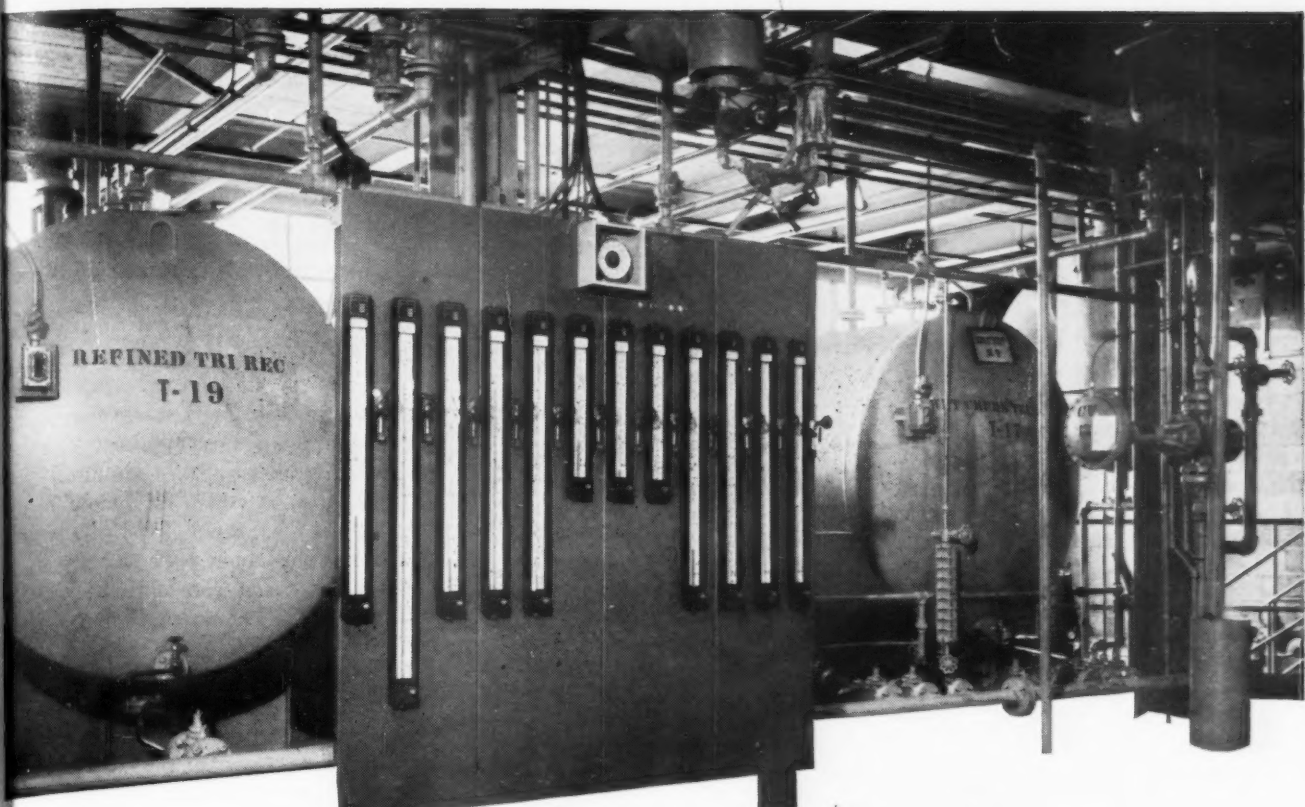
CAL

ND
RS
Metals,
- De-
Plants
Supply

York 3

icago 5

1951



Guarded Quality in **NIALK TRICHLORethylene**

The most modern facilities in the industry are behind the production of NIALK* TRICHLORethylene.

So . . . for a metal-cleaning and degreasing agent of highest quality and stability, order from Niagara.

A PAMPHLET containing information on properties of NIALK TRICHLORethylene is available on request. Just send in coupon below.

*Trade-Mark

NIAGARA ALKALI COMPANY

60 East 42nd Street, New York 17, New York

EBG Liquid Chlorine*
NIALK Caustic Potash
NIALK Carbonate of Potash
NIALK Paradichlorobenzene
NIALK Caustic Soda
NIAGATHAL (Tetrachloro
Phthalic Anhydride)*
NIALK TRICHLORethylene

Niagara Alkali Company, Dept. B
60 East 42nd Street, New York 17, N. Y.

Gentlemen: Please send me a copy of your pamphlet on
NIALK TRICHLORethylene.

Name _____
Position _____
Firm _____
Street _____
City _____ State _____

PATENTS

Cleaning Machine

U. S. Patent 2,510,858. J. F. Black, assignor to Circo Products Company.

Apparatus for removing dirt, grease and the like from metal articles contained in a cylindrical vessel comprising means including a nelongated table and a pair of spaced parallel roller-carrying shafts carried by the table to engage and support such a vessel, stationary abutment means comprising a pedestal disposed below the table to limit tilting motion of the table in one direction to a predetermined extent, said pedestal having sloping upper edges to engage the table and support it in inclined position, trunnion means supported by the pedestal including a bar extending transversely of the table below an intermediate portion thereof and pivotally engaging the table intermediately of its ends, and means for axially rotating the vessel comprising a drive shaft and mechanism operatively associated with the drive shaft and the roller-carrying shafts for rotating the latter shafts.

Molybdenum Plating

U. S. Patent 2,512,141. C. C. Ma and M. W. Offinger, assignors to Westinghouse Electric Corp.

The method of coating a conductive surface of an article of metal, not attacked by weak acids and alkalis, with metallic molybdenum, comprising forming a 10% to 20% aqueous solution, within a pH range of 4 to 12, of a compound of molybdenum selected from the group consisting of the alkali molybdates and the perchlorate, the sulphate, and the chloride of molybdenum, placing said article in said solution, depositing a plating consisting

essentially of molybdenum sesquioxide thereon by making it the cathode, and then heating said plated article to a temperature above 600°C. in a gaseous reducing atmosphere to reduce the plated compound to metallic molybdenum.

Purifying Manganese Plating Baths

U. S. Patent 2,511,507. J. Koster, assignor to Crimora Research & Development Corp.

In the method of treating a manganese-ammonium sulphate solution for electrolysis to produce a deposit of alpha manganese, wherein sulfid ion is added to remove traces of metallic impurities and the solution is filtered, the step of oxidizing the sulfide ion remaining in the solution after such filtration which comprises agitating the solution in the presence of air to the completion of the oxidizing reaction, and thereby converting all of the sulfide ion present into partially reduced sulfur compounds and colloidal sulfur; adding a finely divided, inert, absorbent material to clarify the solution; filtering the clarified solution; and electrolyzing said solution.

Chrome-Molybdenum Alloy Plating

U. S. Patent 2,516,227. C. C. Ma, assignor to Westinghouse Electric Corp.

The method of electroplating comprising dissolving chromic oxide in from 6 to 7 times its weight of water, dissolving molybdenum trioxide equivalent to about $\frac{1}{3}$ the weight of chromic oxide in said solution, adding sulphuric acid equivalent to about 1% of the weight of the chromic oxide, heating to a temperature up to 40°C., and passing electric current therethrough, using a base metal cathode and an anode of molybdenum, and continuing the passage of said current for about five hours to form a deposit on the cathode of a molybdenum-chromium alloy containing from 1% to 30% of molybdenum in closely-adherent form.

Chromium Plating Bath

U. S. Patent 2,517,441. R. Raab, assignor to Ductile Chrome Process Co.

A plating bath for electrolytically depositing chromium, being characterized by superior throwing power, high current efficiency and substantially constant low concentration of trivalent

chromium, consisting essentially of an aqueous solution containing per gallon of solution from about 8 to 70 oz. chromic oxide, from about 0.1 to 3 oz. hydrofluoric acid and from about 0.001 to 1 oz. of an organic acid selected from a class consisting of malic and tartaric acids.

Fingerprint Remover Solution

U. S. Patent 2,517,636. W. Davis, assignor to Shell Development Co.

A clear soluble uniphase liquid composition adapted to remove fingerprint deposits from nonabsorbent surfaces consisting essentially of about 45% to 70% by weight of a clear soluble oil, about 10% to about 37.5% by weight of water and about 15% to about 50% by weight of a substantially volatile, liquid, organic compound selected from the group consisting of benzene, trichloroethylene and carbon tetrachloride, said clear soluble oil consisting essentially of the following components in proportions by weight as follows: Spindle oil — 55, sodium naphthasulfonate — 30, sulfated fish oil — 5, water — 5, diacetone alcohol — 5.

Stabilized Chlorinated Solvents

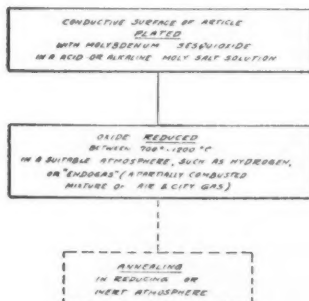
U. S. Patent 2,517,893. A. W. Larchar, assignor to E. I. du Pont de Nemours & Co.

A cleaning composition stabilized against decomposition consisting essentially of a volatile aliphatic chlorohydrocarbon solvent boiling below about 150°C. and from .02% to 1%, based on the weight of said volatile aliphatic chlorohydrocarbon solvent, of a five-membered heterocyclic compound boiling below 175°C., having as ring atoms, three carbon atoms, one nitrogen atom and one atom selected from the class consisting of oxygen and sulfur atoms and wherein any ring atom substituents other than hydrogen are alkyl groups containing less than four carbon atoms.

Stabilized Trichlorethylene for Aluminum Degreasing

U. S. Patent 2,517,894. A. W. Larchar, assignor to E. I. du Pont de Nemours & Co.

A metal degreasing composition stabilized against aluminum-induced decomposition in the liquid and vapor phases consisting essentially of trichloroethylene and from .02% to .25% of cyclohexene based on the weight of said trichloroethylene.



Adding Brighteners to Nickel Baths

The following table gives the amount of brightener addition to make up various sizes of plating tanks to bring the brightener concentration up to specifications. As most brightener concentrations are given in "% by volume," these figures are used in the table.

% by volume to be added	Pints of Brightener or Addition Agent to be Added									
	Tank Size in Gallons									
	100	200	300	400	500	600	700	800	900	1000
.025	.2	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	2.0
.050	.4	.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
.075	.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0
.100	.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0
.125	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
0.2	1.6	3.2	4.8	6.4	8.0	9.6	11.2	12.8	14.4	16.0
0.3	2.4	4.8	7.2	9.6	12.0	14.4	16.8	19.2	21.6	24.0
0.4	3.2	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8	32.0
0.5	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	36.0	40.0
0.6	4.8	9.6	14.4	19.2	24.0	28.8	33.6	38.4	43.2	48.0
0.7	5.6	11.2	16.8	22.4	28.0	33.6	39.2	44.8	50.4	56.0
0.8	6.4	12.8	19.2	25.6	32.0	38.4	44.8	51.2	57.6	64.0

(from "Plating Tips"—L. H. Butcher Co.)

Recent Developments

New Methods, Materials and Equipment
for the Metal Finishing Industries

New Finish for Aluminum

Chemclean Products Corp., Dept. MF, 64 Sixth Ave., New York 13, N. Y.

Announcement is made by the above firm of a new material for finishing aluminum, either as a base for paint or to protect the bare metal from corrosion.

This material, called Protecto-Cote, is provided already mixed and needs only to be dissolved in water, 6 oz. per gallon. The work is immersed in the solution at 185°F., remaining in the bath about 5 minutes. No electric current is required. The equipment consists only of steel tanks with facilities for heating. The solution is said to be "self-cleaning", making the process a one-operation job. Control is simple and easy, and cost of operation is, therefore, very low, it is claimed.

This material may be used on machined parts as well as decorative consumer products, since no dimensional changes take place and close tolerances are not disturbed. As a base for paint, a high degree of adhesion is provided and the corrosion resistance is of a high order, according to the firm.

Small Hard Chrome Plating Unit

Ward Leonard Electric Co., Dept. MF, Industrial Chrome Div., Mount Vernon, N. Y.

The normal life of most cutting tools and wear parts can be multiplied 3 to 10 times by a new and economical industrial hard chrome plating process embodied in the Model A-20 Chromaster and Chromasol.

The Model A-20 Chromaster provides production industries with com-



plete facilities for hard chrome plating metal surfaces up to 10 square inches at the recommended current density of 2 amps. per sq. in. Unit is compact and completely portable.

Powered by a dry disc, power pack selenium rectifier, it is complete with plating bath tank, heavy duty rheostat, timer, ammeter and reversing switch for stripping action. The hard chrome deposition can be controlled to tolerances of less than 0.0001" with the Chromaster, it is claimed.

Operating at room temperature, Chromasol is a new, non-critical chrome plating solution shipped to the user in a liquid, concentrated form. Chromasol delivers a hard chrome plate; the rate of deposition remains constant at 0.002" per hour.

Using this process 1½ minutes is the average time required to hard chrome cutting tools and wear parts and fortify them against chip-loading, galling actions and heat wear.

Fulflo Air Filters

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

One of the "widgets" offered by the above firm for electroplaters is the Fulflo Air Filter to remove rust, scale, dirt, free oil and moisture from compressed air lines. It will be useful for baths requiring air agitation, for lacquer rooms, and for work blowoff purposes, and any other requirements where clean, dry air is important. The filter and replacement cartridges are available from stock in ¾" pipe size with mounting bracket.

The Fulflo air filter is sturdily constructed of steel. It does not have to be disconnected from the air line for service. The head is held in place with a single center bolt and only one nut need be loosened to change the filter element. A non-corrosive metal deflector passes oil and moisture to the sump, after which any remaining traces of free moisture and oil are separated by the cartridge which is sealed at top and bottom so that no unfiltered air can pass.

Fulflo Air Filters operate at pressures up to 125 pounds per square inch with capacity up to 60 cubic feet of free air per minute.

Built-In Scraper Cleans Strainer

Sarco Company, Inc., Dept. MF, 350 Fifth Ave., N. Y. 1, N. Y.

The built-in scraper blade of this pipe line strainer cleans the screen while the fluid is flowing thru the line. There is no cause for shut-downs to



remove and clean the screen. The job of removing screens is eliminated.

The manufacturer claims that it puts an end to the hazard of screen leakage and permits the use of a closer mesh screen.

Scraper Strainers remove solids or scums, without interruption of flow.

Inside the cylindrical screen is a Scraper Blade which rotates like a worm gear. This motor-driven blade hugs the inside of the screen and scrapes off the foreign particles as quickly as they are trapped.

Since the Scraper Blade keeps the screen clean at all times, it is possible to use a closer-mesh to remove the smallest particles of foreign matter. If the solution forms a scum, then a

Brush-Scraper is furnished to wipe the screen surface.

The body, Scraper and screen can be ordered of any suitable metal and the screen can be lined with a metal gauze. Available in sizes $\frac{3}{4}$ to 8".

Bright Dip for Aluminum

Kaiser Aluminum & Chemical Sales, Inc., Dept. MF, 1924 Broadway, Oakland 12, Cal.

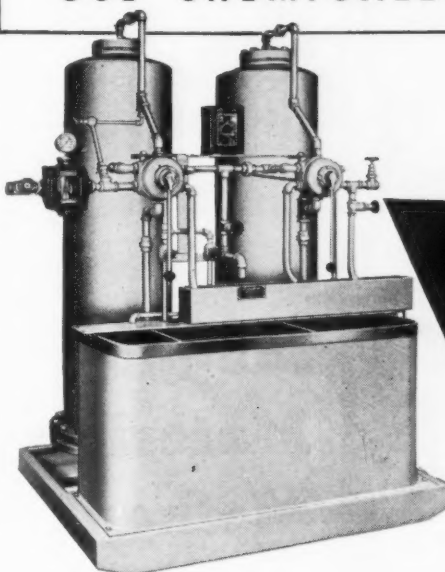
The advantages of the Kaiser Bright Dip bath are claimed to be many; 1—the bath has a low specific gravity (1.027), is thus less viscous than other chemical brighteners in present use, is easier to rinse, and gives less loss in dragout and a minimum of pits and gas tracks due to this low viscosity. 2—The life of the bath is long. As many as 90 square feet of surface are said to have been bright-dipped per gallon of bath, with small additions of the active components to maintain operating efficiency. 3—A relatively simple titration control is all that is necessary to govern the "free acid" in this low concentration solution. 4—Since the acid concentration is low, Type 347 stainless steel finishing tanks can be used for bright-dipping. 5—Due to the composition of the bath there is less fuming than is found in other chemical brightening methods. Kaiser Bright-dipping is done at temperatures of 195 to 210°F. However, even at boiling temperatures no obnoxious fumes are given off during Bright-dipping.

The procedure for Bright-dipping is simple and direct. For the highest specular reflectivity, pieces are first bright-dipped to remove the oxide film. Then they are buffed, cleaned in a non-etching cleaner for 5 minutes, and rinsed in cold water. Following the rinse, they are Bright-dipped for two to five minutes and again rinsed in cold water. A metallic smut which forms during the second dipping is then removed



Eliminate Hot-Rinse Stains Unwanted Precipitates

USE CHEMICALLY PURE WATER



only a few cents
a thousand gallons
with . . .

INDUSTRIAL Water Demineralizers

A Two-Bed INDUSTRIAL Water Demineralizer. Standard two- and four-bed units available with capacities of 200 to 1000 gph. Special units of any capacity engineered to requirements.

and it's as simple as it looks . . .

besides the extremely low cost, there is nothing complicated about getting the chemically pure water with Industrial Demineralizers. Raw water is passed through either two or four beds of ion-exchange resins and it comes out free of the dissolved mineral salts. No still, heat, steam, or cooling water is needed—keeping space requirements relatively small.

And it's simple to get the complete facts for your case. Send us a water analysis and let us know how much water you have to treat and the gallons per hour needed. We can then give you the whole demineralizer story including estimated costs, equipment required, performance data, etc. for your requirements.

for solution clarification . . .

use an INDUSTRIAL Filter

100 to 15,000 gallons per hour. Portable and stationary models. Standard or special filtration systems engineered to meet unusual requirements.



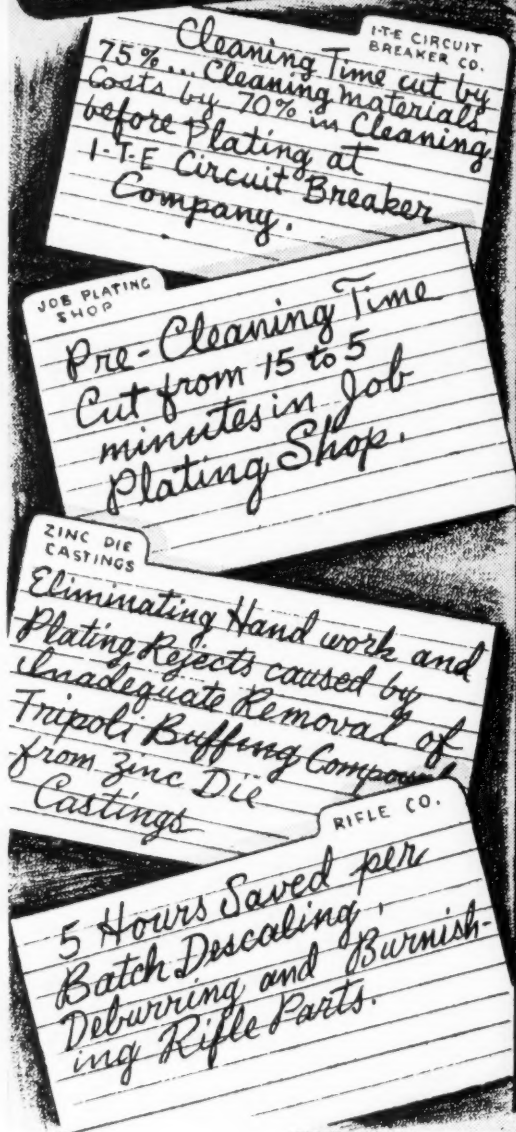
Write for full information and recommendations

INDUSTRIAL FILTER & PUMP MFG. CO.

5906 Ogden Avenue
Chicago 50, Illinois

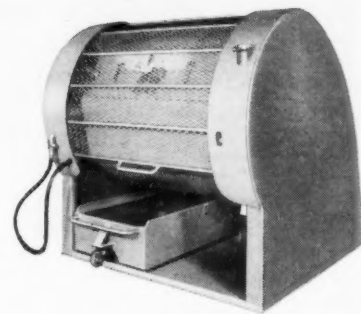
FILTERS	PUMPS	CORROSION TESTING APPARATUS
Pressure Type	Centrifugal	Salt Fog • Humidity
RUBBER DIVISION		
Vulcanized Linings • Molded Products		WATER DEMINERALIZERS

CASE HISTORIES



You, Too, Can Cut Costs and Improve Cleaning with Magnus Materials Methods and Machines

For information, write Magnus Chemical Company, 11 South Ave., Garwood, N. J. In Canada—Magnus Chemicals, Ltd., Montreal. Service representatives in principal U. S. cities.



Other outstanding features contributing to the improved design of the Grav-i-Flo machine are: compartments are furnished with $\frac{1}{2}$ " plate unlined or $\frac{1}{4}$ " plate rubber-lined. Doors have cam locks with manually released safety stops to provide pressure relief. The magnetic starter has a reduced voltage control to meet plant electrical standards. A lever is standard on the machine but a push button switch is optional. A limit switch on the safety guard cuts off current to stop barrel rotation when guard is lifted. The 220-440 volt 5 H.P. motor has a magnetic brake. Water and electrical services are integral with the machine and available for instant, convenient connections. Safety guard is counterbalanced for easy lifting. Hoist pan tubular yoke with unusually operated lock.

Other equipment and materials available for the Grav-i-Flo tumbling process are Grav-i-Flo Super-Brite finishing chips rated to cut 25% faster on nonferrous metals, and which eliminate such subsequent operations as ball burnishing; Grav-i-Flo compounds, which change chip surface from finishing to cutting in minutes, thus eliminating need of transferring parts from cylinder; Grav-i-Flo natural and synthetic de-burring chips for all metal alloys; motor-driven separator for removing chips from parts.

Dipping Baskets

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

Proper selection of the right material for dipping baskets used in cleaning, plating, etching, bright dipping and deoxidizing cycles is made simple by a special table showing the correct material to use for any given purpose; also tables covering an extremely wide range of materials, meshes and sizes of wire for standard baskets. Special baskets are also available, designed and manufactured to individual specifications and requirements.

by a 10-second dip in nitric acid. After the smut removal, the pieces are again rinsed in cold water preparatory to anodizing or zincating.

This process is said to develop a surface comparable in color and reflectivity with buffed silver.

Where brightness is desired without necessarily maximum specular reflectance, unbuffed material may be cleaned in a metal washing machine or a vapor degreaser prior to bright-dipping. In processing unbuffed material, only one bright dip is used.

Kaiser Bright Dip can be used on all aluminum alloys it is claimed, but it is most effective on high-purity aluminum, on alloys 2S, 3S, 52S, 61S and 150S and on the clad forms of 24S and 75S.

Kaiser Aluminum Bright Dip will be made available under license to aluminum fabricators through Kaiser Aluminum & Chemical Sales, Inc., Dept. MF, Palmolive Bldg., Chicago.

Tumbling Machine with Increased Capacity

Grav-i-Flo Corp., Dept. MF, 400 Norwood Ave., Sturgis, Mich.

A new tumbling machine designed with an increased capacity for grinding, de-burring and finishing metal parts is now being offered by the above firm. The new machine, with its two 24" x 40" I.D. compartments, is rated to handle a 30% larger work load than comparable machines occupying the same sq. ft. of floor space.

Small Portable Water Demineralizer

Inley Products, Inc., Dept. MF, 254 Pearl St., New York 7, N. Y.

This firm announces "Demon", a new portable water demineralizer, operated without meters, valves, or electrical connections. It is designed for simplicity of operation, to produce better than triple distilled water at a very low cost and rapid rate. It makes demineralized water available now to all plants, fulfilling the need in even the smallest shops.

The unit attaches to the wall near the water tap, and is ready for immediate operation.

Applications are in metallizing, electroforming, electroplating and metal finishing, etc., where mineral-free water of high quality and low cost, is desired.

Spray Washer for Solvent Cleaning

Phillips Manufacturing Co., Dept. MF, 3475 Touhy Ave., Chicago 45, Ill.

The Phillips SolVoJet is designed to bring safe, rapid and thorough cleaning to your plant. Because the SolVoJet handles petroleum, emulsion, and light compound solutions as well as toxic and non-toxic solvents, any new cleaning problems are overcome quickly by recharging the unit with the proper solvent. This flexibility, and the ease of maneuvering the SolVoJet to the source of the problem, assures its varied usefulness and contributes savings through reduced material handling and increasing production, it is claimed.

Soil is removed by room temperature solvent action and the pressure jet required to dislodge stubborn particles



Lustrous



Are you seeking newer and better methods . . . increased production . . . lower costs . . . less accidents? Investigate the *SIEFEN SYSTEM* of lustrous polishing and buffing without delay!

WRITE FOR FURTHER INFORMATION

J. J. Siefen Co.

5641 LAUDERDALE • DETROIT 9, MICH.
Nationwide buffing and polishing service

is supplied by a carefully selected rotary type pump equipped with mechanical seals. The pump is operated by a foot switch, and a conveniently located adjusting valve permits quick regulation of the pressure. The operator is free to work with both hands, one directing the jet of solvent while the other manipulates unexposed parts and surfaces. The cleaned parts are then drained or subjected to compressed air blowoff when complete removal of solvent is required.

Permanent Cartridge Water Demineralizer with Flow Meter

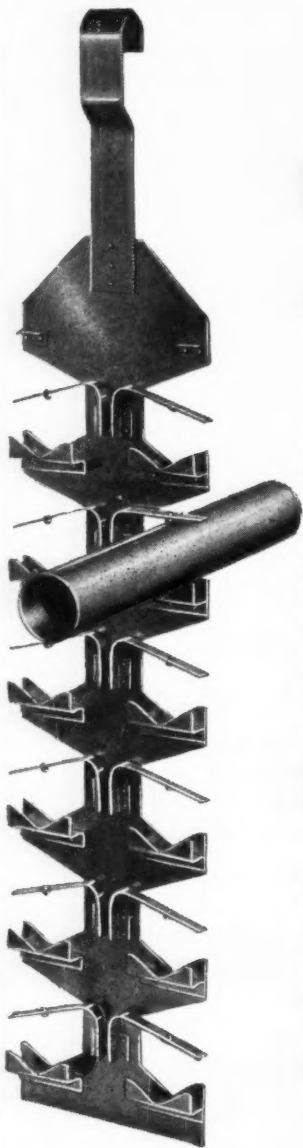
Penfield Mfg. Co., Inc., Dept. MF, 19 High School Ave., Meriden, Conn.

The above firm has announced the availability of a new Ion Exchange

Demineralizer for laboratories and other users of up to 10 gallons per hour of high purity, demineralized water.

Designed to attach to any wall near a tap, the new demineralizer has a permanent cartridge and is equipped with an exclusive Flow Meter, a sight indicator that enables the operator to adjust flow intake to the proper rate for most efficient results. The permanent cartridge feature of the new demineralizer does away with the necessity of purchasing expensive new cartridges and screens when the resin charge needs replacing, it is claimed. All that is necessary is to remove the cartridge, dump the exhausted resins, and refill with a fresh charge of Penex Mixed-Bed resins.

An electric conductivity meter built



AIR DRY INSULATION Anodizing Racks Fixtures

New air drying insulation for aluminum racks and fixtures used in anodizing will prevent destruction of costly racks and stop useless waste of current.

BUNATOL No. 796 is a high gloss black insulation of good body that can be applied by dipping, brushing or spraying. Formulated to resist acid solutions as used in anodizing operations. Excellent adhesion. Just a few coats provide a tough insulation that will resist abrasion and shop abuse. A low cost insulation operation which can be handled in any shop without use of an oven for baking.

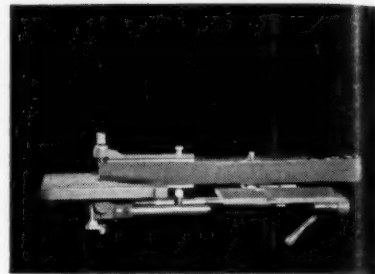
STOP OFF

A new quick air drying lacquer for use on aluminum to stop off anodizing. Dries

fast and holds the edge. Just peel off to remove. A time and labor saver for selective anodizing.

Just a note on your letterhead will bring complete information on these interesting new BUNATOL products.

Nelson J. Quinn Company
TOLEDO 7, OHIO



Used as an accessory to any drill press it eliminates need for extra space. Simply mounting on a drill press column, the Grant grinder readily swings out of the way when not in use.

Using standard 2 1/2 x 60" belts, the Grant contour grinder is efficient and economical for job or production runs. Change of belt ratio or spindle provides speed ranges from 7,000 to 36,000 R.P.M. (700-4,500 feet of abrasive per minute). A special interchangeable spindle attachment provides continuous roll form or cylindrical grinding. Felt wheel blanks may be shaped to meet varying requirements. Table may be moved to rear of driving pulley for exceptionally large grinding operations. Special equipment available includes a spindle grinding attachment using 3/8" to 2" diameter abrasive sleeves for internal surfaces.

Single Tank Deionizer

Elgin Softener Corp., Dept. MF, Elgin, Ill.

A recent development in the field of water conditioning is a single tank deionizer that is claimed to bring the cost of high-quality deionized water within the range of those who have heretofore found evaporated or distilled water prohibitive in cost.

The best way to test the degree to which mineral impurities have been removed from water is to test its electrical resistance. According to this firm, good quality distilled water has about 50,000 to 500,000 ohms specific resistance, while the specific resistance of water delivered by the Elgin deionizer is claimed to be above 5,000,000 ohms—from ten to one hundred times greater than that of most distilled water.

Using single-tank rather than multiple-tank equipment, the investment cost for this new type deionizer is said to be considerably lower.

Two types of resinous zeolite exchangers are used in the deionizer;

into the unit provides a continuous visual indication of the quality of the treated water being produced, warning when the resin charge should be renewed.

Complete details about the new Penfield Permanent Cartridge Demineralizer may be secured by writing.

Water Displacing Solvent

London Chem. Co., Dept. MF, 607 S. Dearborn, Chicago 5, Ill.

Used as a cold dip, Hydrolift instantly forms a molecular film, even in the deepest crevices, lifting the moisture to the surface where it runs off. This film, when dry, is transparent and can neither be seen nor felt. Coverage of Hydrolift is 3,200 square feet per gallon, according to the firm.

Hydrolift is ideally suited as a dip, spray, or brush-on after water rinsing of all metal surfaces, assuring maximum protection of metal surfaces during inter-operational and short term finished product storage. It is said to eliminate the need for water-drying operations, with their attendant water-spotting, oxidizing and hydrating effect on metal surfaces. Hydrolift neutralizes finger prints and prevents water stains, it is claimed.

Contour Grinder

George F. Grant Co., Dept. MF, 36 Kempton Pl., West Newton, Mass.

This firm announces the new Grant contour grinder, a practical precision belt grinder with many special features.

one for the positively charged ions (cations) and one for the negatively charged ions (anions). The cation exchanger is regenerated by a dilute acid solution; the anion exchanger by a caustic solution. Instead of requiring separate exchanger tanks for each exchanger as in former deionizing equipment, the two exchangers are intermixed in a single tank. These exchangers have a marked difference in density which permits them to be divided by backwash into two zones for separate regeneration, as illustrated. Each regenerant solution is introduced into its proper zone. Thus, in this simplified equipment, water is deionized, the zeolite mixture separated into its components, the two resins regenerated, remixed and again returned to the deionizing cycle. Simple manipulation of a multiport valve and supplementary controls accomplish (1) backwashing, (2) regeneration, (3) mixing the zeolites, (4) return to service.

PR Copper Plating

Hanson-Van Winkle-Munning Co.,
Dept. MF, Matawan, N. J.

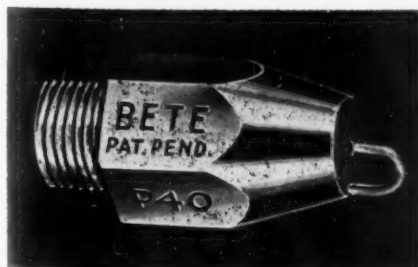
Technical instructions for the use of the Wes-X addition agent in all potassium cyanide plating baths for maximum leveling, buffability, speed, ductility, throwing and covering power, by the elimination of all organic additions to the bath. Instructions include detailed methods of analysis and an effective test for determining the local thickness of H-VW-M bright copper deposits.

Fog Nozzle

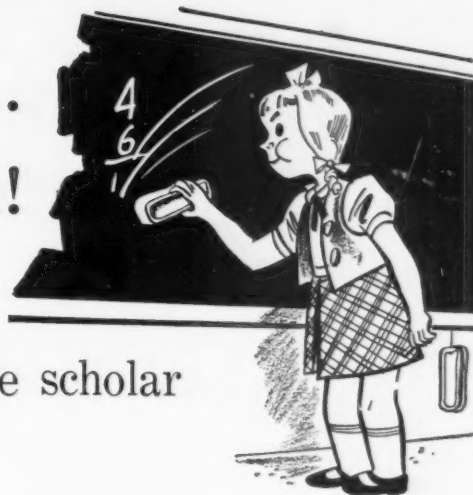
Bete Fog Nozzle, Inc., Dept. MF,
Greenfield, Mass.

Extremely fine and uniform fog droplets at low operating pressures are claimed for a new line of low gallonage nozzles by this manufacturer.

Employing the "pin-jet" impingement principle, the new nozzles have no internal parts and cannot clog with foreign particles smaller than the ori-



Start Clean... Stay Clean!



A good rule for the scholar and the plater

A lot of expensive time and labor goes into preparing metal for plating. *You can waste it all by putting the work into a plating bath of questionable purity!*

Start clean . . . stay clean! Red Label Darco S-51 adsorbs to its surface the impurities that cause trouble in plating baths before they can be deposited on the freshly cleaned surface of your work.

Red Label Darco is especially treated for use in plating — the only carbon that meets the benzol-mercury test! It is especially easy to handle . . . to wet . . . to incorporate into a slurry. Place an order for Red Label Darco S-51 today. Practically all leading suppliers carry Darco in stock. *Do not accept substitutes!*

Is your plating bath as
clean as the water in your
final rinse?



DARCO DEPARTMENT ATLAS POWDER COMPANY

Darco General Sales Offices
60 East 42nd Street, New York 17, N. Y.

fice size, according to the manufacturer.

A new pin design reduces interference of the pin with the fog pattern, a defect common to previous nozzles of this type.

The nozzles are made in 10 orifice sizes from .015 to .080" dia. with flow rates from 1 to 100 gallons per hour. They are available from stock in brass with stainless steel pins, and made to order in various other metals.

Bright Nickel Bath with Levelling Properties

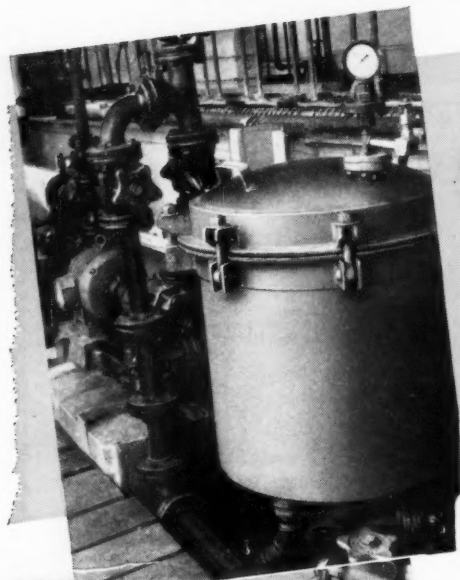
The Gill Corp., Dept. MF, 5317 St.
Clair Ave., Cleveland, O.

This firm announces their new Smoothex nickel plating process, which is claimed to have the outstand-

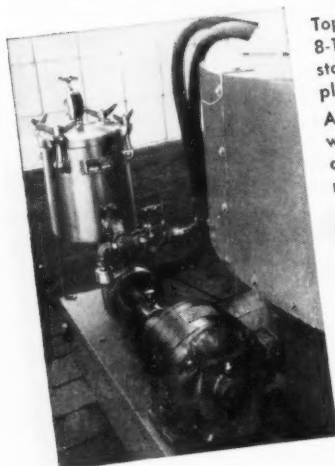
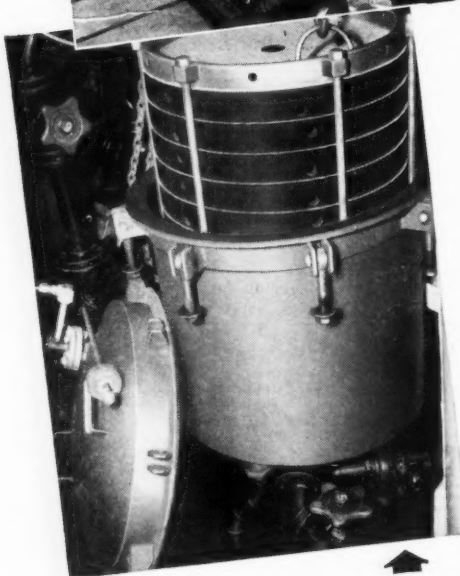
ing combination of bright plating plus good levelling properties. Based on a modified Watts formula, the new bath makes use of specially developed brightening agents which are added to the bath as liquid additions. The bath operates at a pH of 4.0-5.0, and is said to have unusual ability to plate nickel over itself and to give a nickel plate that remains active for long periods of time, requiring no activation before chrome plating.

In addition to depositing a very bright plate, the bath is said to provide a levelling effect better than that obtained even in dull or semi-bright baths specially formulated for their levelling effect only. The firm claims that over 40,000 gallons of the new bath are now in operation in one of

No repairs or maintenance in over 17,000 hours of 'round-the-clock operation



... yet this
SPARKLER
Horizontal Plate
FILTER
is still going strong



Top: Sparkler Model 8-18 filter shown installed in Gillette's plating department.
Above: Same filter, with filter plate assembly being removed for cleaning

Left: Sparkler Model 8-6 stainless steel filter. This portable unit is used by Gillette to filter gold plating solutions.

The kind of service Sparkler Horizontal Plate Filters have given the Gillette Safety Razor Company—efficient and trouble-free, even under most extreme conditions—is the kind of service that is vital to *every* filtering operation.

For example: A rubber-lined Sparkler Model 8-18 filter is used by Gillette in the continuous filtration of a 1000-gallon bright nickel plating solution. Now operating for approximately two years, this filter has been on a 24 hours a day, 7 days a week schedule—without any loss of operating time for repairs or maintenance. Also used in periodic batch carbon treatments of nickel solutions this unit, according to Gillette technicians, consistently delivers a brilliantly clear effluent, even though the plates may be packed solid.

Another Sparkler Filter employed by Gillette is a Model 8-6, stainless steel, portable unit. Used exclusively for cyanide type plating solutions, this Model 8-6 has proved particularly valuable for Gillette's gold plating operations since the patented Sparkler Scavenger Plate assures minimum loss of precious gold solution. Now operating almost six months for at least 2 hours daily, its performance has been satisfactory in every respect.

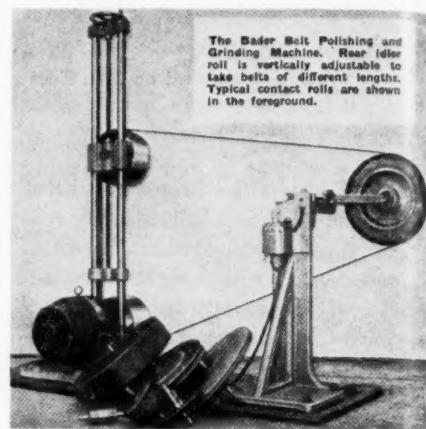
Our Engineering Department (with more than 25 years' experience in every phase of filtration) is available for consultation without charge.

SPARKLER MANUFACTURING CO.
MUNDELEIN, ILLINOIS

the nation's largest manufacturing plants. Complete details may be obtained by writing to the above address.

Contour Polisher for Intricate Work

Stephen Bader & Co., Dept. MF, 253
Langdon Blvd., Rockville Centre, N. Y.



The Bader Belt Polishing and Grinding Machine. Rear idler roll is vertically adjustable to take belts of different lengths. Typical contact rolls are shown in the foreground.

This firm announces their latest development in the field of contour polishing machines, utilizing a new principle of having the backup roll act as an idler wheel, with the lower rear roll acting as the driver. By using this principle, it is impossible to have sharp cornered objects dig in and tear the belt, and avoids puckering of the belt under the work, according to the manufacturer. Belts as narrow as 1/2 inch can be used on this machine, making possible the polishing of intricate parts such as scissor handles, surgical and dental instruments, etc.

The machine is adjustable to accommodate belts from 6-14 feet in length and back-up wheels up to 18" O.D. The manufacturer claims that this machine is extremely versatile, and can be used as a strap polisher by using the unsupported portion of the belt. Contact wheels run on ball bearing shafts, and the position of the contact wheel can be varied to suit the operators' position. Further details and data sheet may be obtained by writing to the above address.

Plastic Tubing

Munray Products Div. of Poly-Cyclo
Products Co., Dept. MF, 12500 Cross-
burn Ave., Cleveland, O.

With the completion of its new plant and equipment expansion program, this firm makes available their Cyclon crystal-clear flexible plastic tubing—a new medium for the conducting of all types of solutions in a

variety of applications from the transfusion of blood plasma in hospitals to the transmission of hydrochloric acid in chemical plant processing.

Extruded to a variety of diameters and wall thicknesses, Cyclon tubing can be utilized interchangeably for pressure and vacuum operations. High temperatures extrusion anneals Cyclon to remarkable strength and toughness, it is claimed.

Cyclon tubing is said to retain all the desirable physical and electrical properties of rubber, yet is far superior to rubber in its ability to resist chemical attack.

All solutions are clearly visible when Cyclon Tubing is used, as it has no opacity or yellowish cast.

Being thermoplastic, Cyclon is not recommended for continuous exposure to corrosives at temperatures beyond 180 degrees Fahrenheit (approx.). It can, however, be used with complete safety at zero temperatures. Although becoming less flexible with cold there is no brittleness nor tendency towards shattering, it is claimed.

Besides clear, Cyclon tubing is also available in colors.

Business Items

Buckeye Products Co. Appoints
E. G. Goss in Detroit Area



E. G. Goss

The Buckeye Products Co., Cincinnati, manufacturers of Speedie buffing & polishing compositions and distributors of a complete line of polishing

METAL FINISHING.

FREE

ASK FOR
BOOKLET
No. B1



IF YOU PRODUCE PARTS THAT REQUIRE FINISHING OF ANY KIND

This 22-page booklet is guaranteed to open your eyes! It gives you the inside story of advanced barrel finishing as never told before!

In the last five years, barrel finishing has made rapid advances. Only those directly connected have been able to keep up. Only 30% of the nation's manufacturers are benefiting from the tremendous cost savings and improved finishes made possible by these advances.

Now is the time to investigate this labor-saving, cost-cutting method. ALMCO barrel finishing equipment has completely paid for itself in as little as two months! This is easy to understand. A single unit installation replaces from two to twelve men. Savings run as high as 95%.

"Advance Barrel Finishing" is the only mass deburring, grinding and finishing method where results are controlled. Amazing results are now possible on almost all types of parts from large castings to small intricate parts. Close tolerance parts can be finished with absolute uniformity to almost any desired micro-inch reading.

WRITE TODAY FOR YOUR FREE COPY

ALMCO Supersheen

AMERICA'S LARGEST MANUFACTURER OF ADVANCED BARREL
FINISHING EQUIPMENT—MATERIALS AND COMPOUNDS
ALBERT LEA, MINNESOTA

KIRK & BLUM FUME CONTROL SYSTEM

60% More Air Less H.P. Lower Cost

at Estate Heatrola Div.,
Noma Electric Corp.
HAMILTON, OHIO

• Although a conventional duct system would have required as much as 100 H. P., this KIRK & BLUM ductless Fume Removal System uses just 40 H. P. to handle 160,000 cubic feet of air per minute . . . doing an excellent job of fume removal at lower initial cost and lower operating cost.

In this plant of this noted stove manufacturer, a battery of ten 8-foot tanks are ventilated by the fume exhaust system shown. Flexibility of capacity is obtained by operation of one or more fans as production requires. Even when baskets containing the parts are lifted from the tanks, the system easily removes all steam and fumes.

Completely designed, fabricated and installed by KIRK & BLUM, this Fume Control System is another example of engineering skill and experience combined to save money for a long list of America's leading plants. For a comprehensive picture of KIRK & BLUM Fume Control Systems, write today for Booklet, "Dust Collecting Systems for Metal Industries."

THE KIRK & BLUM MFG. CO., 2859 Spring Grove Ave., Cincinnati 25, Ohio



FOR CLEAN AIR... THE INVISIBLE TOOL

KIRK AND BLUM

FUME CONTROL SYSTEMS



Charles B. McCoy

degree in chemistry in 1930, and Massachusetts Institute of Technology, where he received a master of science degree in chemical engineering in 1932.

Abrasives Manufacturers Ordered to Make Processes Known

Attorney General J. Howard McGrath announced the entry in the Federal District Court in Boston of an antitrust consent judgment against the four largest manufacturers in the coated abrasive industry, *Minnesota Mining and Manufacturing Co.* of St. Paul, Minnesota; *Behr-Manning Corp.* of Worcester, Mass.; *The Carborundum Co.* of Niagara Falls, N. Y., and *Armour and Co.* of Chicago, Illinois.

The consent judgment, says the Department of Justice, is upon that part of an amended complaint which charged violation of the Sherman Act with respect to domestic trade and commerce in coated abrasives, alleging that defendants have entered into unlawful patent and cross-licensing agreements and other arrangements to fix prices, and had engaged in additional restrictive practices. The judgment accordingly ends such agreements and enjoins the defendants from re-engaging similar agreements or practices.

To create opportunities for the entrance of new competitors in this industry, the judgment orders the defendants to license, to any applicant, their existing patents and patent applications relating to coated abrasives, as well as any such patent rights acquired by defendants during the five year period following entry of this judgment, the Justice Department declared. More than 200 existing patents are

room accessories, announces the appointment of R. G. Goss, Elba Road, Grosse Ile, Mich. as its representative in Detroit, Toledo and surrounding territory. Mr. Goss has had extensive experience and training in the metal finishing field, and is well acquainted in Detroit as the result of some fourteen years devoted to sales engineering in this area. A year ago Mr. Goss branched out for himself as a manufacturer's representative, and is handling buffs, polishing belts, and buffing lathes in addition to the Speedie Compositions such as tripoli, stainless steel, chrome rouge, nickel finish, grease stick, emery cake, jewelers' rouge and greaseless compounds.

McCoy Promoted in Du Pont's Electrochemicals Dept.

Appointment of Charles B. McCoy, director of sales of Du Pont's Explosives Department, as assistant general manager of the company's Electrochemicals Department was announced recently. He succeeds Donald O. Notman, who became general manager of the Electrochemicals Department.

Mr. McCoy, 41 years old, has been with Du Pont since 1928 when he started working during summer vacations from school as a laboratory helper. He attended Wilmington Friends School, the University of Virginia, where he received a bachelor of science

thus subject to compulsory licensing, it said.

Defendants are required to furnish, to any licensee, written manuals describing the methods, processes, materials and equipment used by the defendants in their commercial production under the licensed patents.

Pennsalt to Transfer Production to Cornwells Heights Plant

The Pennsylvania Salt Mfg. Co., announced recently that it will transfer all production now remaining at its Easton plant to its plant at Cornwells Heights, Pa., by December 31. At the same time the company announced it is spending approximately \$250,000 to transfer equipment, install new equipment and improve facilities at the Cornwells Heights plant.

Transferred to the new location will be production facilities for several of Pennsalt's laundry and dry cleaning products, emulsion type metal cleaning compounds, and the eastern re-shipping point for hydrofluoric and anhydrous hydrofluoric acids.

The company also announced that R. W. Tomlinson, superintendent of the Easton plant, has been appointed superintendent of the Cornwells Heights plant, replacing R. O. White, who is to become superintendent of Pennsalt's new plant now under construction at Montgomery, Ala.

Chet Borlet Joins United Chromium

On November 1, Chet Borlet joined the sales and service staff of *United Chromium, Incorporated*. Mr. Borlet, who received his education at Kent



Chet Borlet

State University, has been well known for the past 15 years as a member of the Plating Sales department of The Harshaw Chemical Co.

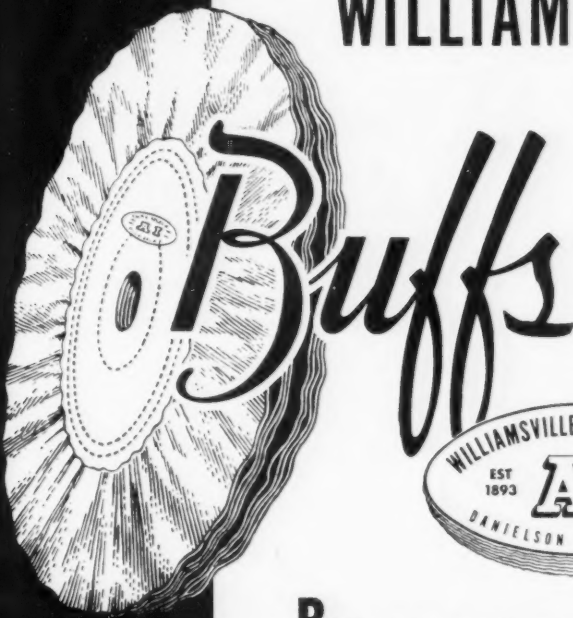
For the last eight years Mr. Borlet has been located in Detroit where he has been active in the local branch of the American Electroplating Society. At the last annual meeting Mr. Borlet was elected to serve on the Board of Managers of the Detroit Branch of the Society.

Upon completion of orientation courses at the United Chromium organic coatings laboratories and plating laboratories at Carteret and Detroit, Mr. Borlet will report to the Los Angeles regional office of the company. From there he will sell and service the entire Unichrome line of plated and


organic coatings for metals including S.R.H.S. Chromium, dips for zinc and cadmium, Organic Product Finishes, and Ucilon protective coatings.

Hot Tinning Facilities Added

Steel Protection & Chemical Co. of Mooreville, Ind., which for many years has specialized in electrolytic lead plating of small parts primarily for the automotive industry, has recently expanded its metal finishing services to include a hot tinning operation as a service to manufacturers of electrical equipment in the Middle West. In initiating this process the company purchased the equipment and business of the Hoosier Retinning Co. of Camby,



WILLIAMSVILLE



BUFFS by Williamsville are dependable in quality — tailored-to-task to meet your particular needs in coloring, cutting and polishing — at lowest possible operating cost. Whatever your problem, let us give you the thrifty solution now!

WILLIAMSVILLE BUFF DIVISION

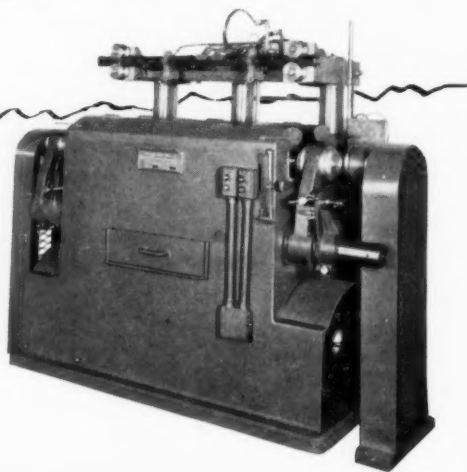
The Bullard Clark Company
DANIELSON, CONNECTICUT

NEW *Central* POLISHING AND BUFFING MACHINE

Pays For Itself in 3 Months*

* A small manufacturer of novelties was faced with tremendous polishing costs. Central proved to him that two Model M4 Central Polishing Machines could cut his costs to a minimum and do a better polishing job at the same time. The machines paid for themselves in 3 months and the manufacturer now pockets the savings. If you polish flat or contoured surfaces in any quantity, it will pay you to investigate the possibilities of this machine. It costs nothing to inquire — ask for Bulletin.

Central Model 4 Hydraulic Finishing Machine (18" stroke) is furnished with a contour attachment for polishing many contoured shapes as well as flat surfaces. Machine is well guarded for safe operation by unskilled operators. Model MM 1 (not shown) has a 36" stroke.



Central MACHINE WORKS
INCORPORATED 1918 75 COMMERCIAL STREET, WORCESTER, MASS.

Ind. The transfer of this hot tinning operation to Steel Protection and Chemical Company will result in greatly expanded production facilities and the capacity to offer this service to many other manufacturers in the Middle West.

Wyandotte Announces Promotion and Retirement

The appointment of *Fred M. King* as Market Development Manager of Food, Beverage, and Special Detergents is announced by *Robert L. Reeves*, General Manager of the *J. B. Ford Div.* of *Wyandotte Chemicals Corp.* Mr. King replaces *Harry A. Rightmire*, who is retiring, effective January 1.



F. M. King



H. A. Rightmire

Mr. King joined Wyandotte Chemicals in 1936. After supervisory and executive assignments in Montana and on the Pacific Coast, he became Seattle District Manager in 1949.

Mr. Rightmire began his career with Wyandotte in May, 1924, as a sales representative in Detroit. He was transferred to the Wyandotte Home Office in 1926 and has for several years held the position now taken over by Mr. King.

General Aniline to Increase Production of Surfactants

General Aniline & Film Corp. is increasing its production facilities for detergents and other surface active agents with new construction and equipment representing an investment of more than \$2,000,000.

This information was disclosed by *Dr. Cary R. Wagner*, Vice-President in charge of Operations, at a two-day sales managers' conference at the company's Central Research Laboratories in Easton, Pa.

The new facilities disclosed by Dr. Wagner are for the Grasselli, N. J., and Rensselaer, N. Y., plants of General Aniline. Some were recently completed and placed in operation, while others will be available in 1951.

Art Perkins New Sales Manager for Roberts Rouge

Theodore F. Onkey, president of *The Roberts Rouge Co.*, Stratford, Conn., announces the appointment of *Arthur L. Perkins* as Sales Manager.

Mr. Perkins enjoys a wide acquaintance and is well known in the metal



Arthur L. Perkins

finishing industry. His practical knowledge, technical background and production experience are assets to his new position.

Mr. Perkins was formerly associated with the Minnesota Mining & Manufacturing Co. and also with Hammond Machinery Builders.

Ward Leonard Enters Hard Chrome Field

Ward Leonard Electric Co., Mount Vernon, N. Y., takes pleasure in announcing the establishment of their Industrial Chrome Division. This new division is engaged in the development and manufacture of chrome plating units, solutions and processes for industrial hard chrome plating of machine tool accessories, and component parts. Exclusive license for the manufacture and sale of the chrome plating solution and plating unit used in the process has recently been obtained by the Company from Chromecraft Corp., Chicago, Ill.

Mr. William G. Dawson has been appointed Manager of the Company's Industrial Chrome Division.

Pennsalt Names Roeller, Tunstall Assistant General Sales Managers

The Pennsylvania Salt Mfg. Co. has placed its six sales departments under the supervision of two Assistant General Sales Managers, it was announced today by William P. Drake, Vice-President and General Sales Manager.

Appointed to these newly created positions and reporting directly to Mr. Drake are R. S. Roeller, who will have general supervision of the Agricultural Chemicals, Heavy Chemicals and Special Chemicals Departments, and Arthur G. Tunstall, Jr., who will super-

THE *Balanced* SOLVENT...

FOR ALL JOBS BLACOSOLV FOR ALL METALS OR COMBINATION OF METALS

Blakeslee SOLVENT VAPOR DEGREASERS
are more economical
more efficient—USE
LESS SOLVENT

NIAGARA

Metal Parts Washers
for use with cleaning
compounds on either
batch or production jobs.

**ONE PRICE
ONE SOLVENT
IS ALL YOU NEED**



HIGHEST STABILIZED DEGREASING SOLVENT—NOT ALKALIZED!

BLACOSOLV contains the finest and toughest stabilizers to prevent solvent breakdown. You need not pay premium prices for special solvents for different metals. Blacosolv can be used over and over, under the most rigorous conditions, without impairing its high qualities.

G. S. BLAKESLEE & CO.

1844 S. 52nd Avenue • Chicago 50, Illinois
New York, N. Y. Toronto, Ont.



R. S. Roeller

vise the B-K and Household Products, Laundry and Dry Cleaning and Maintenance Chemicals Departments.

Mr. Drake explained that the change is intended for more efficient administration of the company's increased sales volume and to enable Pennsalt to increase sales more systematically and at an accelerated rate.

The sales departments will continue to operate as heretofore, but under this change in sales administration Mr. Roeller will have general supervision of sales of bulk or tonnage chemicals and sales to manufacturing industry. Mr. Tunstall will have general supervision of sales of chemical specialties to the service industries, food processors, other light industry, and of consumer products.



This REFINING lot...


...could be YOURS

Lot 219 could be yours—or it could be ours—or it could belong to any of our thousands of refining customers.

You see, when a refining shipment arrives at one of our plants it is checked in, accurately weighed and given a *lot number*. Scrap from our own precious metal manufacturing is handled in the same way. The point is—*every lot gets a number*—and that number is a lot's only identification as it goes through the refining process. None of the men doing the processing knows whose lot it is. This assures the same treatment for all.

Each lot, large or small, is handled *individually*. It goes through one of the most exacting processes known to Industry. The Mayo Brothers clinic is no more impersonal and no more thorough in seeking the cause of human troubles than we are in isolating all the gold, silver and platinum in your refinings.

MAKE THIS TEST If you have not yet used our Refining Service—send us your next lot and compare. We're confident you will be more than pleased with our prompt handling, friendly treatment and accurate RETURNS. Ship to the nearest address below.



HANDY & HARMAN

NEW YORK 7, N. Y. 82 Fulton St.	BRIDGEPORT 1, CONN. 1770 Kingshighway	PROVIDENCE 5, R. I. 425 Richmond St.	CHICAGO 22, ILL. 1900 West Kinzie St.	LOS ANGELES 33, CALIF. 3625 Medford St.
------------------------------------	--	---	--	--

IN CANADA — HANDY & HARMAN OF CANADA LTD., TORONTO

Husting Joins O'Donohue Sales Co.

The addition of *J. O. Husting* to the Sales and Technical Staff has been announced by *Mr. C. F. O'Donohue*, president of O'Donohue Sales Co., of Milwaukee. Mr. Husting, a graduate of Marquette University School of Chemical Engineering, was Plant Engineer of the Ogden, Utah Plant of Solar Corp. prior to joining the firm. Mr. Husting's experience in the field of Electro Chemistry will be utilized in his new position in Sales Engineering and Product Research and Development.

At the same time the firm announced the removal of their general

offices and laboratory to larger quarters at 2326-28 *West State St.*, Milwaukee. Warehouse locations of the firm remain unchanged.

Price of Nickel Increased Again

Effective December 13 the price of nickel metal was increased by 2½ cents a pound. This is the second price increase this year, the previous increase of 8 cents a pound having been made back in May. *The International Nickel Co.*, sole suppliers of this metal, attribute the price rise to their higher cost of production occasioned by a wage increase of up to 8 cents an hour to their Canadian mining and smelting plant workers.

Optimus Equip. Co. Purchases Rights of Circo Products

An announcement of considerable interest has just been made by *Mr. Melville Morris*, President of *Optimus Equipment Co.*, Matawan, New Jersey. It concerns the purchase this week by the Optimus Co. of the trademarks, patents, sales rights etc. of the *Circo Products Corp.*, of Cleveland, Ohio, manufacturers of metal parts cleaning and degreasing machinery.

According to Mr. Morris, the Circo manufacturing operations will be moved to Matawan immediately, where the manufacture and sale of Circo equipment and degreasers will be carried on as the *Circo Division* of Optimus. The present Circo distribution set-up will be continued and expanded.

The purpose of the consolidation, Mr. Morris explains, is to effect various economies, solidify the Circo automotive cleaning equipment operations, and to enlarge the sphere of Optimus activities in the automotive field. Optimus manufactures metal parts washers, vapor degreasers, dryers, and pickling machinery for the industrial field.

Optimus Equipment Company is a subsidiary of *Hanson-Van Winkle-Munning Company*, of Matawan, N. J., oldest and largest manufacturers of electroplating equipment and supplies.

Brush Acquires Faxfilm Co.

The combination of two of the leading manufacturers of surface measuring equipment was announced today by *The Brush Development Co.*, Cleveland, O., manufacturers of the Brush Surface Analyzer since 1939.

Brush has expanded their line of surface measuring instruments by purchasing the business of *The Faxfilm Co.*, Cleveland, O.

Faxfilm offers science and industry a comparatively new tool for rapid study of surface characteristics. In this process, an exact reverse replica of a surface is quickly made in clear plastic. Projection of this replica in a micro-projector provides a magnified picture of the surface with a three-dimensional effect.

Faxfilm is used to study the surface character of many different materials. Information such as surface roughness, grain, lay, tear, porosity and chatter is obtained. This process is unique in that it can be used on irregular shapes

and compound curves without damaging the test piece.

This combination of the Brush Surface Analyzer and Faxfilm now provides both quantitative and qualitative surface analysis.

Faxfilm will now be located at the Brush plant at 3405 Perkins Avenue, Cleveland 14, O. R. W. Cook, formerly president of The Faxfilm Co., has become associated with The Brush Development Co.

Swanton Joins Pfaudler Co.

Walter F. Swanton, formerly instructor in Physical Chemistry, Chemical Engineering and Metal Finishing at the Rochester Institute of Technology, is now with the Chemical Process Engineering Group of the Pfaudler Company, Rochester, N. Y.

Karl F. Jund Joins Globe Chemical Co.

Mr. Karl F. Jund has joined the technical staff of The Globe Chemical Co., Cincinnati, Ohio, and will be in charge of the administration and technical service associated with the Battelle electropolishing and chemical-polishing processes.

Globe is licensed by Battelle to sublicense these processes to interested parties in Ohio, Indiana, Kentucky, Tennessee, West Virginia, and Chicago, Illinois.

Mr. Jund was formerly chief chemist for the McCauley Corp., Dayton, Ohio, in charge of that company's electrochemical finishing division.

Oakite Holds Sales Conference

The photo below shows field representatives from The Canadian, New



MUTUAL RESEARCH

LEADS WAY TO
LOWER COST

CHROMIC ACID TREATMENTS

Possible cost savings in chromic acid anodizing, as well as in other metal treatments such as copper stripping, brass pickling, magnesium dips and chromium plating, are indicated through the use of oxidation-resistant cationic exchange resins. In a preliminary investigation by Mutual Chemical Company of America, certain commercial resins have been found to be stable in the presence of chromic acid. As a result, these resins may be used for removing dissolved metals from chromic acid solutions with the recovered chromic acid made available for re-use. An added advantage is in minimizing the problem of waste disposal.

Write today for a copy of "Regeneration of Chromic Acid Solutions by Cation Exchange" Mutual's Serial No. 65.



MUTUAL CHEMICAL CO. OF AMERICA

270 MADISON AVENUE

NEW YORK 16, N. Y.



WHY DU-LITE IS RIGHT for production black finishing of all steel parts

1-Exclusively for ALL Parts of Steel . . .

Du-Lite was developed exclusively for the black oxidizing of steel. It has been perfected to do this ONE job superbly.

2-A Lustrous Rust-Resistant Black . . .

Du-Lite produces a handsome, uniform, jet black finish — not a coating. Du-Lite becomes an integral part of the steel surface itself, and will not chip, peel, crack, or blister.

3-Easy to Operate - Consistant Results . . .

The Du-Lite Process is trouble-free and results can be achieved consistently without stoppages and slow downs.

4-Reasonable in Cost

Du-Lite is inexpensive to install, and less costly to operate.

5-Backed by Du-Lite's Service and Guarantee

Du-Lite's trained technical men will see that the process is properly installed and train your operators — your guarantee of steady production.

*Investigate Du-Lite's NEW process for blackening
Stainless Steel Parts and Malleable Iron Castings.*

THE DU-LITE CHEMICAL CORPORATION

110 RIVER ROAD • MIDDLETOWN • CONN.

Hotel Statler, New York City.

Similar end-of-year conferences held in Cleveland, O. and Hollywood, Cal. during November were attended by representatives from other regional divisions of the Company.

OBITUARIES

HARRY V. SNYDER

Harry V. Snyder, factory manager of the Manhattan Rubber Co., of Passaic, N. J., died on Dec. 3rd of a cerebral hemorrhage while working around his summer cottage. He was 56 years old at the time of his death.

Mr. Snyder was one of the pioneers in the field of rubber-lined tanks and

chemical processing equipment, and had been with Manhattan Rubber for 40 years. He is survived by his widow, a daughter, and three brothers.

GUS J. SCHAFFNER

Gus J. Schaffner, one of the founders of the Schaffner Mfg. Co., died on Nov. 30th at the age of 65 in Bellevue, Pa. At the time of his death he was a vice-president of the firm. His death was attributed to a heart attack.

He is survived by his widow, three sons, and a daughter.

NORMAN TICE

Mr. Norman Tice, president of the Chromium Process Co., of Shelton, Conn., died at the age of 53.

Mr. Tice was a graduate of Yale,

and started his career with the Apothecaries Hall Co. in 1919. He left there to found the present firm in 1927. He had served in the First World War as a Field Artillery instructor, and was a Mason, a director of the Shelton Trust Co., and a member of the Board of Zoning of Shelton. He is survived by his widow and 3 children.

News from California

By Fred A. Herr



The Metal Finishing Association of Southern California, Inc. regards the present world situation with sufficient gravity that it has voted to send a delegate to Washington, D. C. to partici-

partate in the conferences on the war production situation to be held by the Department of Commerce. The step was undertaken in order to keep the membership abreast of what's going on in the material situation, what shortages threaten, and when and if they can be looked for.

Selected to represent the group at the Washington conferences was E. T. Brown, of Cadmium & Nickel Plating Co., Los Angeles, who is president of the association.

Leo R. Jorgenson has acquired from A. D. Baird the latter's interest in Consolidated Buff Co., now located in enlarged quarters at 1124 East Firestone Blvd., Los Angeles. Jorgenson reports that double the former manufacturing space is now available for the production of sewn and loose buffs, buffs made to special design, and polishing and buffing wheels. Among new machinery recently installed are six latest model power sewing machines. Consolidated Buff Co. has appointed Tony Stabile, formerly with the Modern Plating Co. in Inglewood, Calif., as it's Pacific Coast area sales engineer.

Ed Williams, shop executive of the Douglas Aircraft Co.'s Santa Monica, Calif., metal finishing division, sustained facial injuries recently when his car was struck by a truck loaded with sand while he was driving home from work. He received a severely cut chin and other injuries which kept him con-

fired at the California Lutheran Hospital in Los Angeles from early in December until after the first of the year.

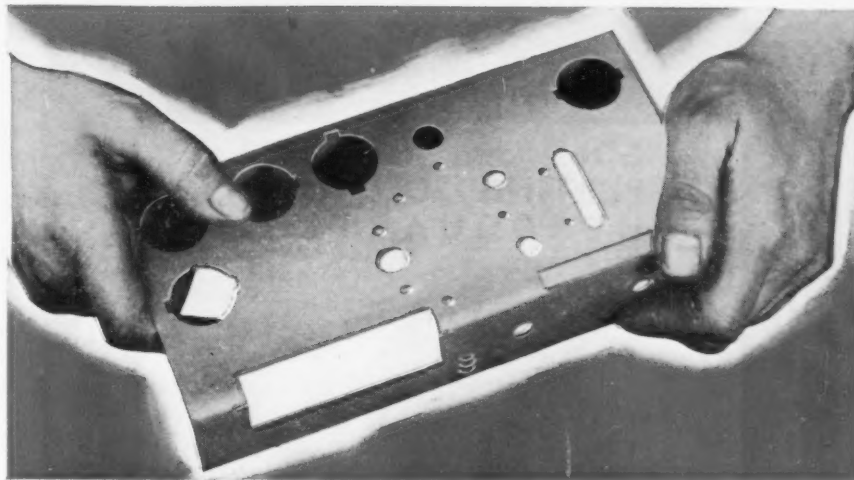
The Rhodes Lewis Co., 3652 Eastham Drive, Culver City, Calif., has completed installation on a plating and anodizing setup, including cadmium, silver and copper and a chromic acid anodizing department.

Joseph Sunderhaus has sold to Peter Traphagen the silver and precious metal finishing shop he had operated for several years at 1016 South Fair Oaks Avenue, Pasadena. The plant is now being operated under the firm name of Peter Traphagen, Inc., craftsmen in silver plating and metal finishing. For the time being, Joe continues to direct shop operations for the new owner but plans soon to retire to West Covina, Calif., where he owns some orange acreage. These days, at AES meetings and elsewhere, Joe's conversation is spiced heavily with references to tree sprays, smudging, irrigation and other trials and tribulations that beset the Southern California citrus grower. "It's as complicated a business as plating", says Joe.

George McDonald, Jr., who is associated with his father in the firm of Hallensheid-McDonald & Co., Los Angeles, was hospitalized by an appendix attack for three days recently. He had recovered sufficiently by December 13 to attend to his chores as secretary of Los Angeles Branch of the AES.

In another expansion move, Industrial Electronics & Transformer Co., Los Angeles, has doubled its office area at 8655 S. Main Street, and also substantially increased the factory area in which rectifiers, transformers and electronic controls are produced. Indicative of the firm's growth is the fact that shop personnel has increased from 20 to 60 since December, 1949. Allen Rosenstein is president, Hal Hudson advertising manager and Keith Holzclaw sales manager.

The Metal Finishing Association of Southern California conducted its November 27 meeting in the View Park Cafe, Los Angeles, in the form of an open forum session. This was done because it was felt that subjects discussed by speakers at previous meet-



COPPER-PLATED PARTS STAY BRIGHT AND CLEAN

When the plating shop treats them with WATER DIP #33

● Forced to switch from cadmium plating to copper plating—on the parts you finish or on the parts you buy?

Then you'll want the full story on a simple, low-cost metal treatment that keeps the copper surface bright and chemically clean—just as it comes from the plating bath. Water Dip #33 prevents finger printing and staining during assembly, storage and use.

IF YOU'RE DOING COPPER PLATING, you can cut out extra operations by using Water Dip #33. Work goes directly from the last hot water rinse into Water Dip #33—no need for rehandling and drying.

IF YOU'RE USING COPPER-PLATED PARTS, you will find that you can make excellent soldered connections, and you can make strong, uniform welds even after the parts have been dipped in Water Dip #33.

Water Dip #33 has many more advantages — in many types of plating. For the complete story, write for Technical Data Bulletin #117 or let our M & W technical consultant discuss your requirements privately with you.

PIONEERS IN
PROTECTION

75th
ANNIVERSARY

MAAS &

M&W CO
1876

WALDSTEIN COMPANY

NEWARK 4, N. J.
CHICAGO 12, ILL.
LOS ANGELES 34, CAL.

PACIFIC COAST DIVISION: SMITH-DAVIS CO., 10751 VENICE BOULEVARD, LOS ANGELES 34, CAL.

MANUFACTURERS OF INDUSTRIAL FINISHES

ings had raised questions in the minds of members that should be brought out in group discussion. The open forum also provided the members with an opportunity to express views on the general situation now confronting the industry with respect to threatened material and manpower shortages.

A resume of activity of the National Association of Metal Finishers was given by Harold Coombes, past-president of the national and local groups. The technical phase of the program was further highlighted by Wesley Cadwallader, of the A. J. Lynch Co., Los Angeles, who gave an analyses of the materials picture, which is changing day by day.

Pennsylvania Salt Mfg. Co. has es-

tablished a new sales office in the Woolsey Bldg., Berkley, Calif., where R. A. Snyder has been named to handle the technical sales service work for metal and maintenance cleaners produced by the firm. He was formerly associated with the Pennsalt Co. at Tacoma, Wash.

American Air Filter Co., Inc., reports the transfer of John Hellstrom from Louisville, Ky., to San Francisco, Calif., where he will serve as manager of the firm's newly established Pacific Division, serving the states of California, Idaho, Washington, Oregon, Utah, New Mexico, Arizona and Western Texas.

Modern Metal Arts Co., manufac-

DAVIS-K

GOLD and RHODIUM PLATING SOLUTIONS HEADQUARTERS

GOLD & RHODIUM
SOLUTIONS



- Made in All Colors
- Colors Constant
- Brilliant Finish
- Tarnish Resistant
- Bottled By Troy Weight
- Made From U. S. Treasury Gold
- Ready For Immediate Use



DAVIS-K—makers of GOLD PLATING SOLUTIONS—prepared in all colors that produce hard, tarnish-resistant, color constant deposits. Compounded from U. S. Treasury GOLD and highest (C.P.) chemicals. Sold by troy weight—certified 100% gold content. Solutions are simple to operate and maintain.

ANTIQUE SOLUTIONS—Deposit gold and antique in one operation—produce uniform finish—simple to operate. Your samples plated at no charge.

We welcome inquiries pertaining to precious metal plating problems. Distributors of Bakers' lustrous RHODIUM SOLUTIONS, that produce a long-lasting white finish.

"Where glittering elegance reflects lasting quality"

DAVIS-K PRODUCTS CO.

54 West 22nd Street ORegon 5-0094-5 New York 10, N. Y.

PERMA-PLUGS STOP TANK LEAKS




Avoid Costly Shutdowns Due to Punctured Tank Linings

Easy to Install—Save Time and Money.

Available in ROUND, OBLONG and SPECIAL SHAPES.

PERMA-LINE RUBBER PRODUCTS Corp.

1753 N. Winnebago Ave. Chicago 47, Ill.

turers of shower and refrigerator doors, has announced completion of an addition to its plant at 4165 S. Main Street, Los Angeles.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY



Twin City Branch

The Twin City Branch of the AES met on Monday, November 6th, in the Evergreen Room of the Hotel Curtis in Minneapolis, with 42 persons present.

President *Al Joyner*, following dinner, introduced the following guests that were present: Messrs. *Carvel Santy*, of Santy Enameling Co.; *W. W. Friday*, of W. D. Forbes Co.; *Jas. Heck*, *William Koram* and *Fred Hanson*, of Brown & Bigelow; *Clifford Nelson* and *Jens Halb* of Jostens, Owatonna, Minn.; *A. W. Pickford*, of Industrial Chemical & Equipment Co.; *Oscar Meline*, of Harshaw Chemical Corp.; *Hubert Goldman*, of Enthone, Inc., New Haven, Conn.; and *Harold Longendyke*, of Twin City Chromium Plating Co.

The following new members were also presented to the Twin City Branch and were given a round of applause: *Howard Jorgensen*, of Owatonna Tool Company Owatonna, Minn.; *John Tobin*, of Standard Varnish Co., Minneapolis; *Charles Kupelian*, of Jostens, Owatonna, Minn. They were welcomed into the Twin City Branch by all present.

Branch Librarian *Paul Hesse*, following the business meeting, introduced the speaker for the meeting, *Mr. Hubert Goldman*, of the Enthone Corp., New Haven, Conn. Mr. Goldman spoke on the subject, "The Plating, Bright-Dipping and Finishing of Aluminum". Mr. Goldman's talk along with slides was one of the most interesting discussions presented before the Twin City Branch and was indicated by the interest around in those attending the meeting. Mr. Goldman was presented with a gift from the Twin City Branch following his talk and was given a rousing vote of thanks for his fine presentation.

Rochester Branch

Thirty members of the Rochester branch were on hand on Nov. 20 to hear a talk by *Mr. E. Von Hondach*, research engineer of the Carpenter Steel Co., Reading, Pa. His subject was "*The Finishing of Stainless Steels*".

The meeting was held at the Rochester Institute of Technology.

Chicago Branch Annual Educational Session

The annual educational session and banquet of the Chicago Branch will be held at the Stevens Hotel on Saturday, January 27. Out of town visitors are especially welcomed, and accommodations at the Stevens have been arranged for them at this event.

An outstanding technical program is being offered, as follows:

Polishing and Buffing—*Mr. C. F. Nixon*, General Motors Corp., Ternsted Div.

Emulsion-Solvent-Alkaline Cleaning—*Dr. Foster D. Snell*, Foster D. Snell Co.

Pickling and Bright-Dipping—*Dr. Cloyd Snavely*, Battelle Memorial Institute.

The educational program will get started at 2:30 p.m. At 7:30 the annual banquet and entertainment will be held. This affair is shaping up as the best in a long line of great affairs that the branch has sponsored in past years. *Mr. Harold Smallman* and *Rudy Haczucha* are Co-Chairmen for the event.

Cincinnati Branch

Due to Thanksgiving, the November meeting of the Cincinnati Branch was held one week earlier, on November 15th, with 30 members and guests present for dinner followed by a business meeting and talk by *Mr. A. G. Russell*, Western Electric Co., Hawthorne, Ill.

President *E. A. Blount* welcomed two new members to the Cincinnati Chapter, *D. L. Taylor* and *G. T. Speers*, after which *Charles R. Sorber* was unanimously elected to membership. The President then introduced *Mr. Russell* who talked on "Electroplating Telephone Relay Parts." Profusely illustrating his lecture with slides, *Mr. Russell* explained the important part relay parts play in the telephone system, and the necessity for proper nickel and chromium plating of these parts. He showed the complete plating operation, giving a detailed picture of the plating

CHEMCLEAN BREVITIES

Organic Finishes

As in electroplating, ADHESION is of prime importance.

For organic finishing, CHEMCLEAN PRODUCTS CORPORATION has outstanding materials:

METAL CONDITIONERS:

CHEMCLEAN S. E. C. for cleaning ALL METALS.

CHEMCLEAN No. 503 for conditioning STEEL.

CHEMCLEAN No. 92 for cleaning ALUMINUM; non-etch.

CHEMCLEAN No. 540 for removal of smut on ALUMINUM.

CHEMCLEAN No. 905 for ALUMINUM; corrosion resistant; THE PERFECT BASE FOR PAINT.

SPRAY BOOTH COMPOUNDS:

Chemclean No. 8. Waterwash compound.

Chemclean No. 800. Dry booth compound.

ORGANIC COATING STRIPPERS:

For all metals including ALUMINUM.

SPECIAL MATERIALS FORMULATED:

For special purposes and special problems.

ASK US. WE'LL FIND THE ANSWER.

CHEMCLEAN PRODUCTS CORP.

Manufacturers of Industrial Cleaners,
Strippers and Chemical Specialties.

64 Avenue of the Americas
New York 13, N. Y.

"We can't make all the cleaners so we make the best!"



RANDALL MANUFACTURING CO., INC.

801 EDGEWATER ROAD + NEW YORK 59, N. Y.

DAyton 3-3900-1-2

Riegel

THE BIAS BUFF

CONSIDER any important item — one you must have for continued production — and you suddenly find the supply cut off, or vastly cut down! And this is happening every day in these uncertain times. Now, how do you feel about it, and what are you going to do about it?

Isn't it better, then, to look beforehand at WHO and WHAT is backing your source of necessary requirements for your plant?

The wise buff buyer looks first for **DEPENDABILITY** in meeting his needs — not only for the present, but later on. If his concern uses a Riegel product he has a sense of security about future purchases. This is a sort of privilege enjoyed by our customers.

The BIAS Buff & Wheel Co.

Division of RIEGEL Textile Corporation

3464-66 Hudson Boulevard
Jersey City 7, New Jersey



COMING EVENTS OF THE A. E. S.

Grand Rapids Branch

Annual Educational Session and Banquet

January 20, 1951

Grand Rapids, Mich.

Chicago Branch

January 27, 1951

Annual Educational Session and Banquet
Stevens Hotel

Chicago, Ill.

New York Branch

February 17, 1951

Annual Educational Session and Banquet
Hotel New Yorker

New York, N. Y.

Los Angeles Branch

Annual Convention June 25-28

Biltmore Hotel

Los Angeles, Calif.

rooms with an explanation of the method and time involved in the cleaning and rinse baths. He then emphasized the use of polystyrene balls, 1" in diameter, as a means of saving chrome, pointing out that the balls were better than rods since they can't cling to the work. Mr. Russell concluded his talk by showing the methods used in racking the relays, pointing out the advantages of hard wiring on the racks so that the relays could be hung on the wires rather than clipped to rods.

After a short question period, the meeting was adjourned for a social hour as the guests of the *Industrial Filter and Pump Co., Chicago*.

Philadelphia Branch

The Annual Educational Session and Banquet was held at Hotel Broadwood, Philadelphia, on Saturday, November 18. The Educational Session had approximately 100 members and guests in attendance. After expressing his appreciation for the work done by the 1950 Banquet Committee, Branch President *Heiman* introduced guests from out-of-town: Messrs. *Horace Smith, George Wagner* and *Myron Diggin*, of the Newark Branch, and *Mr. Braun*, of the New York Branch. Guests were also present from Baltimore-Washington, Lancaster and Allentown-Reading Branches. The meeting was then turned over to the Chairman of the Educational Session, *Mr. Joseph Mazia*.

The first speaker was *Dr. William Blum*, National Bureau of Standards, whose topic was "The Effects of War on the Electroplating Industry". *Dr. Blum* stated at the outset that he was no prophet, nor had he access to "inside" information, but that he was basing his remarks on the experience gained in previous situations. He surveyed the World War II role of the various metals used in plating: the use of nickel for engineering purposes, as for electroforming tubing and similar parts; zinc plating on steel to replace parts made of brass and for corrosion protection (the use of zinc plated steel pennies in 1943 saved five million pounds of copper); the extremely limited use of cadmium due to its scarcity; increased use of chromium for engineering requirements; gold and silver on radar parts and silver on steel tableware; scarcity of tin caused the increased use of electrolytic tin plate, which uses less tin than the hot-dipped material.

From a slide it was shown that, of the metals consumed industrially in the U. S. in 1948, cadmium showed the greatest percentage (50%) of its total usage, used for plating; tin—15%; nickel—16%; silver—10% and zinc—2%. These figures illustrated the difficulty of substituting a scarce metal with one that is scarcer and less used.

Another slide "U. S. Consumption of Nickel" showed how the use of nickel for plating had risen from 7% of the total used (3,500 out of 52,000 tons) in 1940 to 22% of the total used in 1949 (15,000 out of 68,000 tons). These data illustrated the present difficulty of maintaining adequate supplies of nickel with its increased use for plating and other purposes. It was shown that of all the nickel consumed for plating, the automobile industry used 62% of the total, with electrical appliances following with 7%.

In commenting on the present crisis, Dr. Blum called attention to the constant depletion of our metals and the necessity of care being exercised in their use. We may expect increased stockpiling which removes metal from the market for any immediate use; inventory control orders limiting the amount of metals kept in stock to prevent hoarding; military priorities with the military agencies taking what they need through Defense Orders (D.O.); the civilian rationing of nickel to be probably followed by Government order rationing; aluminum and copper now rationed—cobalt also very scarce and probably will be rationed.

As to what to do, Dr. Blum suggested 1) Get D.O. orders; 2) Conserve critical metals by plating less parts, less plated areas or, where possible, less plating thickness. As a warning note to the use of these alternatives, he said it would be a big mistake for the plating industry hastily to cut quality or thickness of plating. As to plating less, it may waste entirely the value of the plating applied. It is much better to encourage inferior substitutions of materials e.g. plastics for metals, than to produce an inferior plating job.

In closing, Dr. Blum stated that plating won't be shelved, nor will it be pampered—changes will be necessary to meet the changing conditions of the present emergency.

The next speaker was Mr. R. O. Hull, of R. O. Hull & Co., who spoke on "New Ideas in Plating and Control". In line with the conservation of metals



C. P. SILVER NITRATE meets A.C.S. specifications

... highest
purity
... delivery
from stock

ALSO MANUFACTURERS OF
APW "AA" SILVER ANODES
AND
APW SILVER CYANIDE

WRITE US FOR FULL INFORMATION
AND CURRENT QUOTATIONS

THE AMERICAN PLATINUM WORKS
231 NEW JERSEY R. R. AVENUE NEWARK 5, N. J.



Get this Booklet Now!

Don't Delay MAIL COUPON TODAY!

FREE!

COMPLETE LINE OF Buffing Compositions TAILORED TO YOUR SPECIFICATIONS

☐ White Finish
 ☐ Grease Stick
 ☐ Tripoli
 ☐ Emery
 ☐ Stainless
 ☐ Spray
 ☐ Bar
 ☐ Paste

SCHAFFNER MFG. CO., INC. • EMSWORTH • PITTSBURGH 2, PA. • ROSEWOOD 1-9902

Attach this ad to your letterhead and receive our new 1951 Buffing Compound and Supplies Catalog.

Get this
BUFFING AND POLISHING COMPOUND
Booklet Now!

CLIP THIS AD TO YOUR
LETTERHEAD FOR FREE
COMPOUND BOOKLET

NAME _____
COMPANY _____
POSITION _____
ADDRESS _____
CITY _____ STATE _____

THERE IS NO SUBSTITUTE FOR *Experience*



The perfection of this product is the direct result of more than 25 years of experience gained in manufacturing many millions of pounds of polishing compounds and other quality-controlled abrasive materials for the production lines of the Automotive Industry and its many suppliers in the field of Metal Finishing. We sincerely believe it to be the best product for the purpose on the market today.
C. H. McALEER, President.

WE KNOW A TEST WILL PROVE

INCREASED PRODUCTION—Scientific "know-how" of the blending of abrasive grains and binders and proper selection of the compound suited for the job gives you the most uniform finish and increases speed of production.

ECONOMY IN USE—The improved and more durable binder gives ideal adhesion to the wheel; drying time and less "off the wheel" wastage.

IMPROVED CONTAINER—Our aluminum-foil container is almost impervious to moisture-loss and when properly stored will remain in good condition for a year.

LABORATORY CONTROL—Constant laboratory control of all raw materials used and experienced supervision of manufacturing processes is maintained at all times.



One of America's Famous Chemical Trademarks

DETROIT CHEMICAL SPECIALTIES CO.

9072 LIVERNOIS AVE. • • • DETROIT 4, MICHIGAN

BOOKS FOR YOUR PLANT LIBRARY

PRINCIPLES OF ELECTROPLATING AND ELECTROFORMING
REVISED THIRD EDITION
\$6.00 PER COPY

METALLIZING NON-CONDUCTORS
\$2.00 PER COPY

DICTIONARY OF METAL FINISHING CHEMICALS
\$3.00 PER COPY

1950 METAL FINISHING GUIDEBOOK-DIRECTORY
\$2.50 PER COPY

Book Orders Payable in Advance

FINISHING PUBLICATIONS, INC.

11 West 42nd St.

New York 18, N. Y.

stressed by the previous speaker, Mr. Hull suggested the use of lower metal content cadmium solution—from 3 to 1.5 oz./gal.; the reduction of chromic acid in a chromium plating bath to 25 oz./gal. to save dragout; reduction of nickel sulfate to 25 oz./gal. in bright nickel solutions with, however, some sacrifice in plating speeds; the addition of nickel sulfate to the solution when nickel anodes get short and of zinc oxide to a zinc solution in the absence of zinc anodes. He showed a series of colored slides which illustrated well the varying results obtained on panels used in Hull Cell tests made with various plating solutions under varying conditions of compositions and contaminations. These are expected to be published in their natural colors and should thus prove an excellent adjunct in performing Hull Cell tests.

Under the heading of "New Ideas", Mr. Hull mentioned new methods of stripping copper from steel, the use of Woods' high chloride nickel solution for striking instead of cyanide copper, the addition of small amounts (1 to 2 hundredths oz./gal.) of sodium hydrosulfite to improve the color of bright copper and minimize blistering, improvements in rinsing to prevent staining of brass, a new cadmium black for the Air Force, and on anti-foaming agent to prevent explosions in zinc plating and cleaning solutions due to ignition by sparks of hydrogen entrapped in the foam. He described briefly and passed around plated specimens of a new bright speculum deposit being developed by Battelle Memorial Institute, not yet released, which contains 40-50% copper, balance tin. It is plated from an alkaline bath that utilizes tin in the stannous state and is unaffected by stannic tin. The deposit is hard and tarnish resistant.

The third speaker was Mr. Arthur W. Logozzo, Nutmeg Chrome Corp. and Past Supreme President A.E.S. who spoke on "Hard Chrome Problems". Mr. Logozzo's opening remark is worthy of direct quotation, "Too much work has been done in the exploitation of hard chrome and too little done in exploration".

He showed slides illustrating the effect of the base metal structure on the deposit—the deposit reflects the basic structure—it does not change it. Data were presented on the cleaning and etching of various steels prior to hard chrome plating and it was stated

that etching is essential to prepare properly uniform structures. With reference to stopping-off, Mr. Logozzo described the use of sheet lead shielding (0.004" thick sheet used widely) next to high points with lacquer or plastic sheeting (Polyethylene) for stopping-off low points. This eliminates the build-up of corners. He recommended the use of light platings of tin or chromium to protect highly finished areas not being plated.

The following cycle for small tools was given:

- 1) Stress relieve (600° to 1,200°F.—check with metallurgist for proper temperature);
- 2) Anodic clean and rinse;
- 3) Acid dip—50% HCl with addition agent;
- 4) Thorough rinse;
- 5) Chrome plate—5 minutes average time for new tools. As little as 1½ minutes may be all that is required. Plated surface must be uniformly bright with no frosted areas.
- 6) Bake—350°F.—1 to 3 hours (30 minutes at full temperature required).

Slides were shown giving practical racking and masking methods for plating 0.00002" to .00003" chromium on scissor blades.

A new color film made by Mr. Logozzo, showing hard chrome plating of various parts, was run-off. It contained a wealth of practical information and impressed the viewer with the painstaking care taken in racking, masking and plating each job to obtain the excellent results shown.

A general question period followed. The Educational Session concluded at 5:35, with a rising vote of thanks given to the speakers and Mr. William Miller, engineer of Philadelphia Rust Proof Co., who operated the slide and motion picture projectors.

The Banquet in the Crystal Ballroom started at 7:00 with 260 attending. An excellent turkey dinner was served, during which many beautiful and valuable door prizes were distributed. This was followed by a topnotch floor show and the evening concluded with dancing.

Los Angeles Branch

Eighty-five members and guests were checked in at the December 13 meeting of Los Angeles Chapter.

This gratifying turn-out for the last meeting of 1950 was attributed by

How one Pittsburgh Brush*



POLISHES 10,000 HEATING UNITS

* An actual case history from The Edwin L. Wiegand Company, producers of CHROMALOX Heating Units.

WHEN this company needed a way to take the ragged edges off heating units economically and fast, they turned to rough, tough Pittsburgh Brushes for the answer. The 6" Pittsburgh steel wire brushes like that shown above polish 10,000 heating units during their life.

LET PITTSBURGH ENGINEERS solve your brush problems. Pittsburgh's complete line of brushes of every type, for every purpose, will provide a practi-

cal, economical solution of any brush problem you might have. Drop us a line on your company letterhead for a copy of our new booklet that shows, through actual case histories, how Pittsburgh can help cut your brushing operation costs.

Address: PITTSBURGH PLATE GLASS COMPANY, Brush Div., Dept. W13, 3221 Frederick Avenue, Baltimore 29, Md.



PITTSBURGH



Power Driven

BRUSHES

BRUSHES • PAINT • GLASS • CHEMICALS • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

WHEN IN NEW YORK

VISIT OUR FREE

PERMANENT FINISHES EXHIBIT

OPEN DAILY 10 A.M. TO 5 P.M. MONDAY THROUGH FRIDAY

SAMPLE COPIES OF OUR PUBLICATIONS and MANUFACTURERS' CATALOGS AVAILABLE FREE

at the offices of

FINISHING PUBLICATIONS, INC.

11 WEST 42nd STREET

NEW YORK 18, N. Y.

President *Dick Wooley* to two causes: The reports that had circulated of truly startling pictures of a Hawaiian volcano in action that were to be shown by *Leo Antimion*, president of the Modern Plating Co., and the advance notices that announced that *J. B. Winters*, of Cleveland, O., research chemist of the *R. O. Hull Co.*, had some extremely vital information to offer on plating shop conservation practices that were timely in view of the present international situation.

It is debatable which of the two program features was received with greater interest. Mr. Antimion projected some color movies of the recent volcano eruption in Hawaii which literally took one's breath away with their startling realism. The films were made during Mr. Antimion's recent trip to the islands. They were taken in a plane from heights of 13,500 feet down, which carried the cameraman literally to the very lip of the fiery crater. The glowingly crimson views of rivers of lava slowly oozing down the mountainside were particularly interesting. A well deserved round of applause came when Leo concluded the showing of the film.

While the announced title of Mr. Winters' talk was "*Plating Materials Conservation through Proper Control*," he broadened the subject considerably under the stimulus of a subsequent question-and-answer period, so that before he concluded his comment covered virtually all phases of shop conservation to which a plater might resort during the critical periods of material and manpower shortages.

The speaker's best received points of information were those in which he presented statistics showing how many ounces or pounds of various metals—chromium, cadmium, zinc, copper—can be calculated to have been consumed for so many amperes used up.

He cited various kinds of conservation methods that could be employed. Only the most foolishly optimistic plater will look for improvement in the supply situation for months to come, he warned. At one point of his talk, Dr. Winters remarked: "If you have cadmium in stock, save it. It might be a long time before you have another chance to get all you want." This advice, he stated, applies with equal force to most other metals also.

His whole talk was devoted to conservation methods that would enable the metal finisher to make his chemicals and metals last as long as possible by eliminating practices that are wasteful. Subjects he touched upon included: How to increase throwing power; prevention of bath treatments; how to prolong the life of a cadmium bath; how to prolong the lives of different types of baths; checks for caustic in cadmium bath; cyanide baths and conservation methods; rejects as a source of solution loss; the fallacy of using the bath as a cleaner during these times.

A spirited 45 minute period of questioning followed at the conclusion of Mr. Winters' talk. Before launching into his technical discussion, Mr. Winters complimented The Branch for the size of its meeting attendance, the efficiently expeditious manner in which the business session was conducted, and the dignified formality reflected by the branch's ceremony for initiating new members. Mr. Winters stated it to be the most impressive initiation ceremony he had witnessed anywhere in AES circles.

TRUE BRITE IS FIRST

TRUE BRITE NICKEL BRIGHTENER was the first nickel brightener definitely designed for barrel plating at higher speeds to match still tank bright nickel and provide for good chromium plating on racks or in barrels.

TRUE BRITE BRASS MAINTENANCE COMPOUND is the first complete brass plating compound designed to take away the headaches of off color deposits. Now available in various ratios for various brass and bronze colors.

TRUE INSULATORS are the first insulators for coils in plating tanks designed especially for the electroplating industry. Available in popular sizes for immediate delivery.

Write for technical bulletins

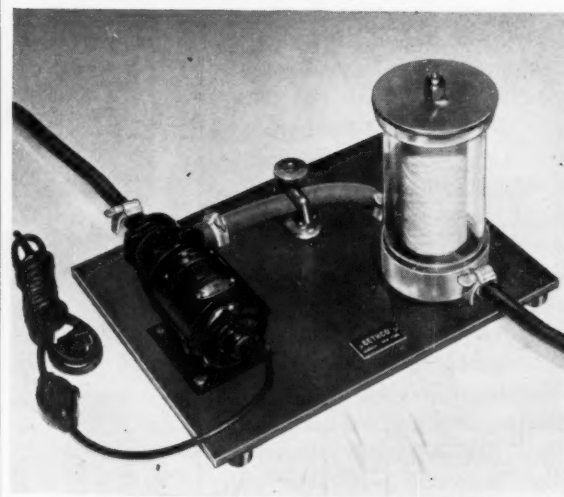
TRUE BRITE CHEMICAL PRODUCTS CO.

P. O. Box #31

Oakville, Conn.

Practical Products for Practical People

SETHCO SEZ . . . Throw Away Your Funnels and Filter Paper



MODEL LSU-5

- **APPLICATION** Filters all electroplating solutions.
- **CONSTRUCTION** High temperature lucite filter cylinder. Highest quality stainless, type 316, pump & fittings.
- **ECONOMICAL** No loss of expensive solutions, complete drainage.
- **CAPACITY** 50 gals/hr : Open pumping—400 gals/hr.
- **FILTER TUBE** Easily rinsed or back washed.
- **COST** ½ price of Sethco's other high quality low priced units.

WRITE TODAY FOR DESCRIPTIVE LITERATURE
SETHCO, 105-07 150 ST., JAMAICA 4, N. Y.

Eight new members were initiated at the meeting, including *M. L. Crompton*, Spence Electroplating Co.; *Raymond E. Steele*, Tool & Jig Plating Co.; *Allen F. Savage*, All-America Mfg. Co.; *Walter Plummer*, Cal-Nevar Co.; *D. L. Merrill*, Kelite Products, Inc.; *Allen Ibanez*, All-American Mfg. Co.; *Keith Holzclaw*, International Electronics & Transformer Co.; and *Erwin Bustamante*, Hudson Plating Co.

Guests at this session were *Gregory Lagutaris*, of the Santa Monica Plating Co.; *Don Fish*, *Dan Helper* and *Dan Althouse*, of L. H. Butcher Co.; *A. Hillman*, Grayson Heat Control Co.; *Robert Minnegh*, *Daniel Miller* and *Al Hawley*.

INTERNATIONAL FELLOWSHIP CLUB

Report of Special Committee Meeting in Detroit

At the Annual Meeting of the *International Fellowship Club* held in Boston in June of 1950 President-elect *George L. Nankervis* appointed a special committee to formulate plans and

inaugurate methods for a closer association with the American Electroplaters' Society. The following men made up this committee:

Mr. A. P. Munning, Mr. D. X. Clarin, Mr. W. D. MacDermid, Mr. A. N. Braun, Mr. R. J. Hazucha, Mr. T. A. Trumbour, and Mr. Manson Glover, as special secretary of this committee.

This Committee formulated a questionnaire which was sent to all members of the IFC. An amazing number of replies were received. On Saturday morning, December 2nd, this committee met at the Detroit Athletic Club and spent the entire day reviewing and condensing these replies, and formed a set of policies which we have submitted as recommendations to the executive officers of the American Electroplaters' Society. These opinions were with direct reference to the financing of future National Conventions.

The replies were practically unanimous in the opinion that they favored a definite restricted convention budget with reference to entertainment. Also, they were practically unanimous in the opinion that the registration fees

should cover approximately 75% of the convention budget.

In the immediate future, The Committee will submit a complete copy of the official report to the Supreme Society which will be available to all interested parties. This report will cover the complete set of recommendations adopted at the Detroit meeting.

The Executive Committee of The IFC acted upon several other important matters:

1. It instructed the Secretary to proceed with the necessary papers for immediate incorporation of the International Fellowship Club.

2. It instructed the Secretary to make arrangements for necessary liability insurance covering future social functions of the International Fellowship Club.

3. The Committee recommended that the International Fellowship Club seriously consider and act upon recommended methods of furnishing financial support to the Public Relations program of the American Electroplaters' Society.

In this latter matter, *Mr. W. M.*

Bright Zinc the easy way

McKeon
Zinc-Brite
TRADE MARK REG'D.

INSURES CONSTANT PURIFICATION

through the precipitation of heavy metal impurities.

Effectively cleanses your zinc solution of copper, cadmium, lead, tin, mercury, and like contaminations as fast as they get into your electrolyte either from the anodes, work, or external sources.

Prevents harmful accumulation of carbonates.

No filtering required. No waiting period. Economical.

CONSTANT BRIGHT PLATING WITH CONSTANT PURIFICATION

INTRODUCTORY OFFER: 1 gallon McKEON'S "ZINC BRITE" with complete set of operating instructions, enough to operate 250 gallons of solution for approximately 1 month, \$3.25.

Sulphur Products Co. Inc.
Greensburg 7, Pa.



SAVES ANODE SCRAPS

Utilize valuable anode scraps with BELKE Anode Baskets. Merely suspend an anode in center of basket and pour anode scraps in around it.

Built for long service, BELKE Anode Baskets are ruggedly constructed of heavy gauge, steel wire-mesh reinforced with frame of welded steel rod. Heavy coating of BELKE Universal Plastic assures protection against all plating solutions.

Made to specified dimensions. For quotation send length, width, and depth of basket you require—or ask your BELKE Service Engineer.

BELKE DIPPING BASKETS—Wire or perforated sheet metal construction in round or rectangular shapes—of steel, stainless steel, aluminum, Monel, Nichrome, copper or brass—uncoated or coated with BELKE Universal Plastic. Many standard sizes, or can be made to order. Write for prices.



Belke MANUFACTURING CO.
947 North Cicero Ave.
Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS

Phillips, of the General Motors Corp., attended this special committee meeting, and expressed his complete satisfaction and appreciation of the efforts that this committee proposed to instigate with reference to the subject of public relations.

Mr. Clyde Kelly, Chairman of the 1952 AES Exhibition Committee, attended the committee meeting, and has advised that the Chicago Branch is going ahead with full plans for a successful exhibition to be held in conjunction with the Chicago Convention in 1952.

The Committee, before adjourning, agreed to accept with gratitude the offer of publications in the plating field of space in their magazines for future reports on IFC proceedings.

The committee has also recommended to the AES Supreme Society that at subsequent conventions the International Fellowship Club be allowed the afternoon of Monday, from one to three, for business sessions. It is their opinion that they will have many interesting matters of business to discuss at future Fellowship Meetings.

AMERICAN SOCIETY FOR METALS



Seventh Western Metal Show in Oakland Week of March 19, 1951

The Oakland, California, Civic Auditoriums will be the scene of the 1951 Western Metal Congress and Exposition, March 19-23, the seventh to be held in the interests of the Western metalworking industries.

Co-sponsoring the Congress activities will be approximately 20 cooperating Technical Societies whose interests apply to the oil, chemical, manufacturing, aviation, mining and other Western industries.

The big event in March next will mark the second time that Oakland has played host to the thousands of metallurgists, engineers, production executives and management officials whose activities and talents have built within the eleven Western States one of the greatest metals producing and

metals fabricating areas in the world. Those who recall the outstanding success of the Oakland meeting in 1947 may well expect an even greater Congress and Exposition in 1951 because of both the growth of the industry and the added strategic importance of the area in connection with National Security.

Heading the general committee of the 1951 Metal Congress and Exposition is Harry Lewis, Chairman of the Golden Gate Chapter of the American Society for Metals. Vice-Chairmen are: Bert Depew, General Electric, and Philip McCaffery, General Metals Corp.; E. A. Daniels, Victor Equipment Co. (representing the American Welding Society), will share responsibilities with the committee's general secretary, Harry E. Krayenbuhl, Oliver United Filters, Inc.

Professor Earl R. Parker, University of California, will direct programming, and W. A. Fletcher, E. F. Houghton & Co., will handle publicity. On the committee for exhibits is G. B. Berlien, Industrial Steel Treating Co., with Paul G. Childs, Earle M. Jorgensen Co., in charge of entertainment, and

BEAM-KNODEL CO.

Metropolitan Distributors

HANSON-VAN WINKLE-MUNNING CO.



Complete Service for Metal Finishing

Products Listed Below Available in New York
Stock With Reasonable Exceptions

GENERATORS

Anodes, All Kinds
Brushes
Bufs
Chemicals
Tripoli Comp.
Acme White Finish

Tallow
Rouge
Emery Paste
Cleaners
Emery
Glue

Nickel Salts
Copper Salts
Cyanide
Tanks, All Kinds
Plating Barrels
Polishing Wheels
Polishing Lathes

195 LAFAYETTE ST., COR. BROOME
Phone CANal 6-3956-7 NEW YORK 12, N. Y.

FILTERS

MAIZO
Drying
Materials

LEA Buffing
& Polishing
PRODUCTS

BUYERS of any QUANTITY of the following SCRAP

- Ni—Anodes
- Ni—Peelings, Strippings, Nodules, Trees
- Cr—Strippings, Nodules, Trees
- Ni—Deposited Iron Hooks, Racks, Hangers
- Tin—Plating Residues
- Cadmium—Trees, Strippings, Nodules, Residues
- Molybdenum—Tungsten
- Gold
- Platinum—Scrap, Residues, Strippings

Write indicating
grade and quantity available

METALLURGICAL PRODUCTS CO.

ESTABLISHED 1909

35th & Moore Streets, Philadelphia 45, Pa.

George A. Nelson, Shell Development, in charge of cooperating Societies.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS



The 1951 Conference and Exhibition of the National Association of Corrosion Engineers, will be held at the Statler Hotel, New York City, on March 13, 14, 15, and 16, it has been announced by L. B. Donovan, Consolidated Edison Co. of New York, Chairman of the General Conference Committee.

The following Technical Symposia will be held:

- 1.—*Corrosion Principles Symposium*—H. H. Uhlig, Chairman, Massachusetts Institute of Technology, Cambridge, Mass.
- 2.—*Pipe Line Industry Symposium*—S. S. Smith, Chairman, Shell Oil Co., New York, N. Y.
- 3.—*Chemical Industry Symposium*—W. Z. Friend, Chairman, Interna-

tional Nickel Co., Inc., New York, N. Y.

4.—*Water Industry Symposium*—R. R. Ashline, Chairman, Dept. of Water and Power, Los Angeles 54, Cal.

5.—*Protective Coatings Symposium*—Kenneth Tator, Chairman, Kenneth Tator Associates, Coraopolis, Pa.

6.—*Oil and Gas Industry Symposium*—T. S. Zajac, Chairman, Shell Oil Company, Houston, Texas.

7.—*Cathodic Protection Symposium*—Sidney E. Trouard, Chairman, New Orleans Public Service, Inc., New Orleans, La.

8.—*Transportation Industry Symposium*—Merritt A. Williamson, Chairman, Pullman-Standard Car Mfg. Co., Hammond, Indiana.

9.—*Electrical and Communications Industries Symposium*—Kenneth G. Compton, Chairman, Bell Telephone Laboratories, Murray Hill, N. J.

10.—*Symposium on Industrial Use of Corrosion Inhibitors*—Aaron Wachter, Chairman, Shell Development Co., Emeryville, California.

11.—*Round Table on General Corrosion Prob.*—F. L. LaQue, Chairman, International Nickel Co., Inc., New York, N. Y.

12.—*Round Table on Pipe Line and Underground Corrosion*—R. L. Bullock, Chairman, Interstate Pipe Line Co., Tulsa, Oklahoma.

Manufacturers' Literature

The Real Secret of Better Plating

Joseph B. Kushner *Electroplating School, Dept. MF, Stroudsburg, Pa.*

A very interesting bulletin recently published by the above school discusses a very pertinent subject of interest to all plating executives plagued with inefficient production in their plating departments. Copies are available at no charge by writing to the above address.

Chemical-Resisting Protective Coatings

United Chromium, Inc., Dept. MF, 100 East 42 St., New York 17, N. Y.

A new bulletin describing five groups of chemical resisting Ucilon protective coatings has been made



- D**EMINERALIZED — Pure water for plating from your faucet.
- E**CONOMICAL — Four cents a gallon or less in most areas.
- M**UST — For precious metal plating, metalizing, electroforming, bright solutions, etc.
- O**NLY — \$14.95 f.o.b. N. Y. C. Ready for immediate operation.
- N**O — Meters, valves or electrical connections. Merely attach to tap.

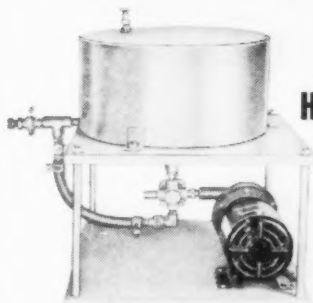
By the makers of ENLEY POLYETHYLENE LINERS

ENLEY PRODUCTS, INC.

254 PEARL ST.

NEW YORK 7, N. Y.

IS YOUR PROBLEM PLATING?

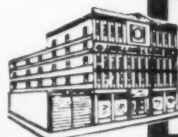


HOLLAND SUGGESTS:

Midget and Junior stainless unit filters. Backwash type.

Contact our technical staff on your metal finishing problems. Write for FREE

folder "P" showing our wide selection of metal finishing equipment.



J. HOLLAND & SONS, INC.

MANUFACTURERS • DEALERS

276 SOUTH NINTH ST. • BROOKLYN, N. Y.

available by this firm. Described are coatings based on vinyl resins, phenolic resins, fish oils, chlorinated rubber, and also water emulsion coatings. The coatings are resistant to acids, alkalies, petroleum and its derivatives, water, oxidants, salt solutions, alcohols, and many solvents. Copies may be obtained by writing to the above address.

Soak and Electrocleaner

Detrex Corporation, Dept. MF, Detroit 32, Mich.

A multi-purpose cleaning chemical, identified as Detrex 10, is described in a new folder being distributed by the above firm.

This compound may be used as a medium-duty soak tank cleaner; electrolytic cleaner for ferrous metal parts; and as a water conditioner for all types of water-wash paint spray booths.

Lead Anodes in Chrome Plating

Knapp Mills, Inc., Dept. MF, 23-15 Borden Ave., L. I. City 1, N. Y.

This firm has prepared a six-page paper, accompanied by illustrative drawings, discussing the subject of

lead anodes and improvements in them, as well as the effect of anodes on chromium plating processes.

The paper includes discussions of conductivity, electro-chemical corrosion, chromium deposits, operating costs, anode life, anode forms, etc. Free copies may be obtained by writing to the above address.

Glacial Acetic Acid

Niacet Chemicals Div., Dept. MF, 1020 Niagara Building, Niagara Falls, N. Y.

Niacet Bulletin No. 1 on Glacial Acetic Acid presents in detail the physical and chemical properties, latest specifications on the standard, C.P. and U.S.P. grades as well as the shipping and handling information on this well-known chemical. Acetic acid is one of the oldest and most important of the commercial organic acids with a great variety of applications throughout industry. Plant men particularly will be interested in checking their handling and unloading of tank cars with the procedure given here. Free copies can be received by writing to the above address.

Corrosion Resistant Materials

Munray Products, Inc., Dept. MF, Div. of Poly-Cyclo Products Co., 12500 Crossburn Ave., Cleveland 11, O.

The above firm has recently published a new bulletin containing information and technical data on many corrosion resistant materials for the processing industries. Among the standard products covered in this bulletin are industrial coatings, adhesives, process equipment linings, extrusions, and chemical tubing and piping. They are also equipped to custom-compound protective materials to meet specific requirements.

For further information address all inquiries to the above address.

Tank and Duct Linings

Carboline Co., Dept. MF, 7603 Forsyth Blvd., St. Louis 5, Mo.

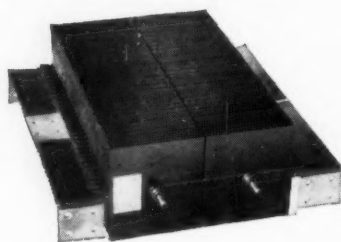
The practical application of thick protective coatings for tank and duct linings and for protection of equipment and floors is covered in a bulletin on a new coating called Carbo-Kote 6020.

Due to a solids content of 100%, fluid and free flowing during applications, coatings can be applied 12 mils



SELENIUM RECTIFIER STACKS FOR ELECTROPLATING POWER SUPPLIES

"Unsurpassed Performance"

3 of these stacks are used in a 10 volt, 5,000 amp. Rectifier Plating Supply Unit.



It pays to specify International Rectifier Corporation Selenium Stacks in your Plating Units. The name "INTERNATIONAL R.C." on the Rectifier Stacks in your Plating Unit is your guarantee of trouble-free, dependable performance.

 Now supplying the majority of manufacturers specializing in Electroplating Power Supply Units. 

WRITE FOR LATEST TECHNICAL BULLETINS

**INTERNATIONAL
RECTIFIER CORPORATION**

6809 S. VICTORIA AVE. LOS ANGELES 43

Step up your Alkaline Tin Plating
with little change in
present equipment

Higher Plating Speed

Because with Potassium Stannate current efficiency does not fall off with higher current densities.

POTASSIUM STANNATE

Economy

High speed means greater production; more output from present equipment.



Investigate Potassium Stannate for both new and existing applications—to increase your output . . . to lower your costs per article plated.

Write for literature!

METAL & THERMIT CORPORATION
100 EAST 42nd STREET, NEW YORK 17, N. Y.

Specialists in Tin

(.012") thick in one application even on vertical surfaces, it is claimed.

Coating hardens at room temperature to a very hard protective film resistant to all acids except oxidizing types, and to practically all solvents and alkalis, according to the firm. While abrasion resistance is excellent, there is sufficient flexibility for steel tank lining service without fiber reinforcement. Carbo-Kote 6020 is non-toxic and non-contaminating, it is claimed.

The new bulletin covers the process of applying Carbo-Kote 6020 on steel and concrete, for which primer coats are required, and on wood, glass, carbon, porcelain, rubber and stoneware, for which no primer is required.

Coverage, drying and working times, corrosion resistance, uses and prices, are given.

Continuous Wheelabrating

American Wheelabrator and Equipment Corp., Dept. MF, 19 South Byrkit St., Mishawaka, Ind.

A new bulletin "Continuous Blast Cleaning Can Reduce Your Cleaning Costs" is now available from the above firm.

The heavily illustrated, 8-page book-

let explains the advantages offered by continuous airless abrasive blast cleaning and cites actual production figures for the five sizes of Wheelabrator Continuous Tumblasts.

A free copy of Bulletin No. 454 may be obtained by writing.

Dust Collectors

Torit Manufacturing Co., Dept. MF, 320 Walnut St., St. Paul 2, Minnesota.

The complete line of Torit dust collectors, and their application to standard and special dust problems, are described and illustrated in a 28 page catalog just released by the above firm. Among the units shown are cabinet dust collectors in sizes ranging from $\frac{1}{3}$ HP to 5 HP, and cyclone separator types from $\frac{1}{2}$ HP to 5HP.

New items described in this catalog include special purpose units in both cabinet and separator-type Torit dust collectors. These units have extra large dust storage capacity, and are designed to facilitate the emptying of this dust into containers for salvage or disposal.

A Torit Twin Cyclone dust separator is also described for the first time in this new catalog. Equipped with a 5

HP, 3,450 RPM motor, it tests 2,100 c.f.m., velocity 6,000 ft. per minute, static pressure 3", with its 8" inlet operating.

Pumps for Processing Industries

Yeomans Brothers Co., Dept. MF, 1433 North Dayton St., Chicago 22, Ill.

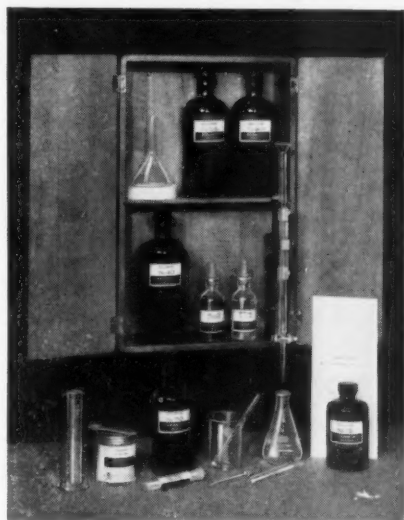
A full line of pumps for handling corrosive and non-corrosive liquids, solids-carrying liquids and dry and semi-dry materials is presented in a new condensed catalog issued by the above firm.

For easy use and reference the book is organized in sections as follows: Corrosive and Non-Corrosive Liquids—with emphasis on vertical submerged centrifugal pumps, a type developed and pioneered by Yeomans; horizontal end-suction circulating pumps.

Solids-Carrying Liquids—horizontal and vertical non-clog centrifugal pumps, a type developed and pioneered by Yeomans; horizontal end-suction circulating pumps.

Solids-Carrying Liquids—horizontal and vertical non-clog centrifugal pumps to handle solids, in various styles and different bearing constructions; and the Shone pneumatic unit.

TEST SETS FOR ALL PLATING NEEDS EASY...No knowledge of chemistry required QUICK...Direct reading



Write for Literature

KOCOUR CO.
4802 S. St. Louis Ave. Chicago 32, Ill.
Specify Kocour Sets From Your Supplier.

DEPENDABLE SALT SPRAY TESTING EQUIPMENT

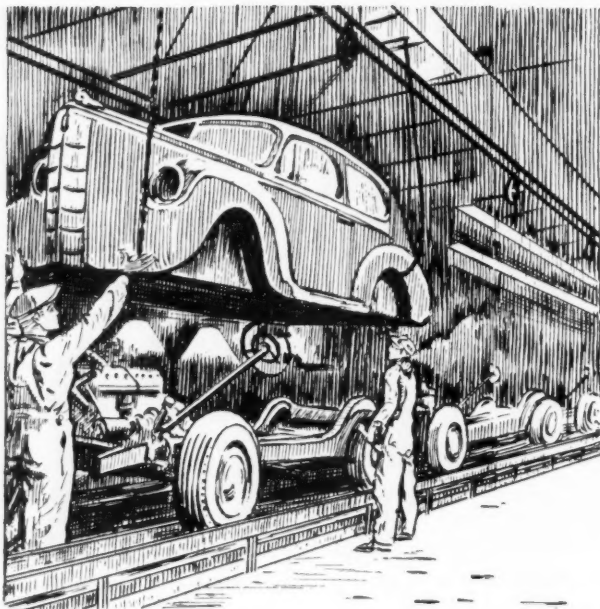


Be Sure You Meet Government Specifications

You can test for compliance with critical government plating specifications by using BELKE Salt Spray Equipment. Easy to use — built for long service — economically priced. Tests corrosion resistance of plating, anodizing, galvanizing, paints, synthetic coatings, etc. For information consult a BELKE Service Engineer, or write.

BELKE
Salt Spray
Bulletin 709
furnished
on request.

Belke MANUFACTURING CO.
947 N. Cicero Avenue
Chicago 51, Illinois
EVERYTHING FOR PLATING PLANTS



MOTOR CITY PLATING NEWS



by

Edward Finne

Bleak is the future for Detroit plating.

Recent and immediate cuts in metal allocations has and will greatly affect the platers in this automotive center.

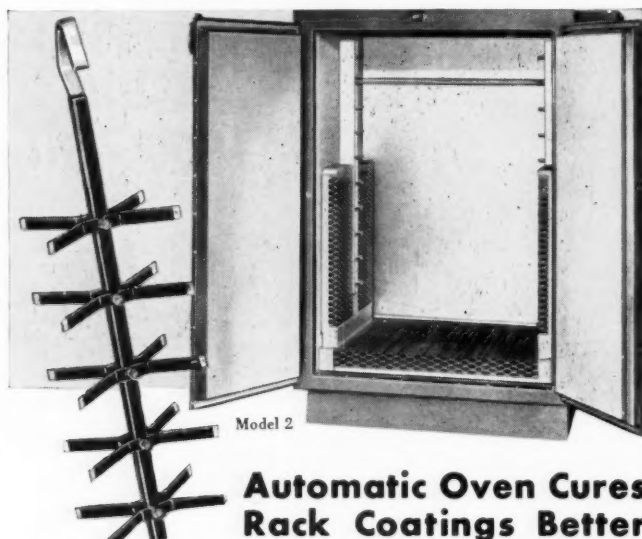
True, there has been reduction of nickel thickness on auto parts, but the reduction in plate thickness does not compensate for government reduction

of this metal to the industry. Even though the industry is allowed a percentage of nickel, platers are having a time getting their allotted share.

Aside from metal shortages, we can expect a cut back of jobs — estimates are given of greatly reduced production and subsequent unemployment sometime in late January up to early

March. This will give many a "no-work" period until defense production can get into swing, which may be in late summer.

As far as defense work in job plating shops in Detroit is concerned, a check reveals that the percentage of defense work being plated ranges from zero to 2%. Those shops doing bright plat-



Model 2

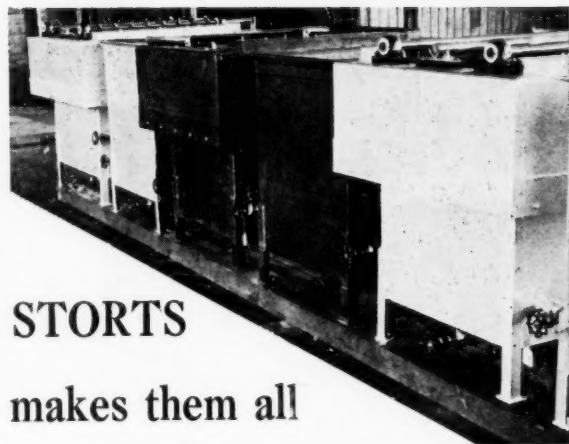
Automatic Oven Cures Rack Coatings Better

Automatically maintains correct preheating and curing temperatures for proper coating of plating racks. Holds any temperature for which set (between 300 and 450°F.). Layout of efficient Rack Coating Department and complete information on BELKE Electric Ovens in Bulletin 1061. Ask your BELKE Service Engineer, or write.

Inside dimen.	MODEL		
	1	2	3
WIDE	24"	36"	48"
HIGH	48"	48"	48"
DEEP	24"	24"	24"
F.O.B. CHICAGO	\$495	\$605	\$780

Other sizes to specifications

Belke MANUFACTURING CO.
947 North Cicero Ave.
Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS



STORTS

makes them all

WHATEVER your tank requirements may be, STORTS fabrication experience and sound welding practices assure better performance, while reducing your maintenance and replacement costs. Your inquiries are invited on single tanks, replacements or complete new tank cycles.

STORTS
WELDING COMPANY
INCORPORATED

38 Stone Street
MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

ing exclusively have no defense work; those with rust-proofing facilities have up to 2% of their total work classified as war work.

The *Midwest Chrome Process Co.* has moved from 2627 Magnolia to new and larger quarters at 2771 Hammond Ave., Detroit. 10,000 square feet of floor space is available at the new location and houses new equipment for finishing of small plated parts. The firm specializes in barrel chromium plating of steel, brass, stainless steel and zinc die-cast parts.

A new plant makes its appearance in the plating field in Detroit. *Norbrook, Inc.*, with plant at 11572 E. Nine Mile Rd., VanDyke, and sales office at 19875 Mack Ave., Grosse Pointe is headed by *K. C. Jones*, president. Jones has *C. J. Fineraty* as vice-president and *James M. Northrup* as secy-treas. The plant is housed in a new building of 3,000 square feet and features an 1,800 gallon still zinc line as its first plating venture.

Jones was formerly sales and service man at Northwest Chemical Co., and Fineraty was part owner of Fine-Finish of Detroit.

The *Peerless Novelty Co.*, of Grand Haven, Mich., now has a sales office at 510 Stephenson Bldg. in Detroit.

Fred Conley is representing this company in the Detroit area. Peerless has been established 32 years, and manufactures and plates automotive and refrigerator hardware on a production basis.

Detroit Branch

The AES's largest branch held its annual meeting on Dec. 2, 1950 at the Hotel Statler in Detroit.

This, the largest crowd-producing of all the annual events, provided a technical session in the afternoon and a dinner dance in the evening. Educationally, the event catered to about 350 persons — entertainmentwise, the dinner dance was attended by over 1,650 persons, the largest in the history of the society.

Headlining the technical session was the talk by *Richard E. Krafve*, Director of the Office of Defense Products of the Ford Motor Co. His talk, "Source of Our Strength", was a discussion of his views as to industrial mobilization during this partial war period. In addition, he discussed the subject of defense contracts for small business. His talk was very well received.

George W. Jernstedt, Manager of Electroplating Projects, Westinghouse Electric Corp., gave his interesting talk on "Application of WES-X Copper and PR Plating".

Harland V. Ogle, Instructor of Physical Chemistry at Michigan State College, co-author with Dr. D. T. Ewing of State of the paper "Distribution of Metallic Impurities in Nickel Deposits" lectured on this subject.

The evening entertainment, which was so well attended that it taxed the facilities of the hotel, was a tremendous success. It featured the usual excellent dinner and floor shows running simultaneously in the two rooms needed to house the vast crowd.



IT CHECKS ITSELF!

TYPE LSI

SARCO Electric

TEMPERATURE CONTROL

Inexpensive, exacting temperature control combined with continuous indication of the controlled temperature. Control temperature may be changed by turning a thumb screw. Actuates electric heaters, motors or solenoid or motor valves. Catalog No. 1025.

288

SARCO

SAVES STEAM

IMPROVES PRODUCT QUALITY AND OUTPUT

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO



Stutz

"Lucite Ribless"

PORTABLE PLATING BARREL



The best looking — The best mechanically — The best in production! The best from any way you look at it. Revolves through the entire plating cycle without transfer of load from one cylinder to another. Maximum solution temperature 185°F. Made in Two Sizes:

6" x 12"	\$203.50
8" x 18"	\$302.50

with reversing switch and plug-in cord and with standard perforations of 3/32" or larger.

Small perforations
\$8.25 to \$27.50 extra

As Lucite is non-absorbent, one unit can be used for all your solutions. Order today — this is the best investment you can make for your plating room.

THE FINEST OF ALL

Stutz

Selenium Rectifiers

Ideal for still, barrel, and automatic tank operation!

We invite your inquiries covering any amperage or voltage.

STUTZ—Your Guarantee of Quality!

GEORGE A.

1645 CARROLL AVENUE

STUTZ

PRODUCTS

MFG. CO.

CHICAGO 12, ILL.

Letters to the Editor

Removing Excess Oxidant from Nickel Baths with Hydrogen

Mr. W. A. Raymond, Eng. Editor
Metal Finishing
New York, N. Y.

Dear Sir;

Some time ago we had at our works a rather interesting incident occurring to one of our nickel solutions after a chemical precipitation by perman-

ganate. This nickel bath had lost its throwing power, so no plate could be obtained in recesses. A checkup at our laboratory showed permissible values of oxidant matter and part of this bath was tried for bright nickel using certain organic standard brighteners. A large percentage of these brighteners were consumed by our un-known oxidant, but the bright solution worked to perfection after a 50% additional dose. As our chemically treated nickel bath was a dull Watt's-type solution, we had to crack this oxidant by other means, and therefore employed hydrogen supplied compressed in a steel container with valve and rubber hose. This worked as intended, giving us a normal dull bath free from contamination and with good throwing power.

As this problem might be encountered by other platers the writer is passing this information along in the hope that it might be helpful to them.

Sincerely yours,

H. C. QVARNSTROM

Metal Finishing
11 W. 42nd St.
New York 18, N. Y.
Dear Walter:

After receiving the entire contents

of this year's Guidebook, I would sincerely like to congratulate you and your staff for a job well done. This year's Guidebook is by far the most informative book of this kind ever published and I think the metal finishing industry owes you and your company many thanks for bringing a book of this kind to the people connected with our work.

Sincerely yours,

MILTON NADEL

Mr. Walter Raymond
Metal Finishing
New York 18, N. Y.
Dear Walter:

I have just received my copy of the



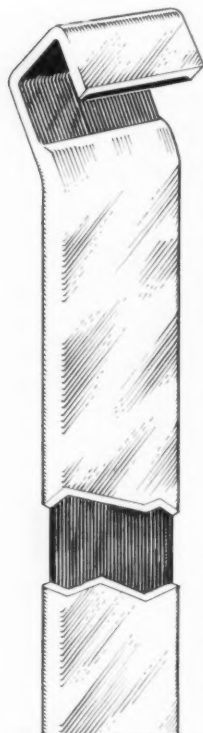
Hartford
GUARANTEED
STEEL BALLS
Best for Burnishing . . . Perfect for Polishing. No culls, no cracks.
Mixtures as Required
THE HARTFORD STEEL BALL CO.
HARTFORD 6, CONN.

SOMMERS BROS. MFG. CO. MFRS. OF "BEACON"

Plating and Polishing Supplies and Equipment
—Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds—Buff, Polishing and Felt Wheels.

WRITE FOR PRICES

3439 NO. BROADWAY
ST. LOUIS 7, MO.



Electro-Cupralum Anodes

FOR CHROME PLATING

A NEW AND REVOLUTIONARY DEVELOPMENT
Electro-Cupralum Anodes are manufactured by combining copper and lead through a Homogeneous Extrusion Process whereby the two metals are chemically and inseparably bonded together. The resultant product consists of a full width continuous copper electrode with a Homogeneous lead covering on all sides except the underside of the copper hook.

FEATURES

1. Ten times the electrical conductivity of any Lead Anode.
2. Faster, better plating.
3. Even distribution of current through solution.
4. Permanently rigid.
5. Tenacious, insoluble coatings.
6. No build-up of temperature.
7. Periodic cleaning unnecessary.

Electro-Cupralum Anodes are superior because they combine the superior conductivity of copper with the superior protection of lead.

KNAPP MILLS, INCORPORATED

Executive Offices:

23-15 BORDEN AVE.

LONG ISLAND CITY, N. Y.

Corrosion Proof Construction Materials CEMENTS FLOORS LININGS COATINGS

Rely on Atlas' years of experience and recognized leadership to help solve your problems. Write 31 Walnut Street, Mertztown, Pa.

Over a half century of service



Atlas

MINERAL PRODUCTS COMPANY
MERTZTOWN, PA. HOUSTON, TEXAS

SPEED-UP your nickel stripping bath by adding STRIPODE

Cuts acid consumption . . . protects base metal . . . reduces pitting and roughening . . . minimizes need for buffing and coloring.

WRITE FOR FULL
INFORMATION

The CHEMICAL CORPORATION

54 Waltham Ave.
Springfield, Mass.

1950 Guidebook, and after looking it over think you have done a bang up job on it. It is undoubtedly the best of the series, with the approach to the subject definitely on a more scientific basis than ever before.

Sincerely yours,

JOSEPH B. KUSHNER

Mr. Walter A. Raymond,
Managing Editor
Metal Finishing
11 West 42nd Street
New York 18, N. Y.
Dear Walter:

The 1950 Guidebook-Directory looks like an excellent job all the way through, and you are to be commended

for it. Before studying the book, I thought of several subjects I would like to see covered, but when I got to the book I found them all presented in good form.

Best personal regards,

C. FRED GURNHAM

NEW BOOKS

Tinplate Handbook

By W. E. Hoare. Published by the Tin Research Institute, 492 W. Sixth St., Columbus, O., Free.

Steelmaking and tinning processes used in making hot-dipped and electroplate are covered. Major uses for each type, methods of testing, trade terms, grading and classifying, coating weights and thicknesses, and an English-French-German-Spanish dictionary of tinplate trade terms are all included. Copies may be obtained free of charge from the above address.

Porosity of Electrodeposited Metals — Parts IV-IX

By Thon, Kelemen, and Yang. Published by the American Electroplaters Society, P.O. Box 168, Jenkintown, Pa.

A progress report by the AES Research Project No. 6. This report covers the measurement of very low porosities by the Low-Pressure-Constant Overpressure method, the measurement of the corrodibility of metal foils,

the effect of the surface structure of the base metal on the permeability and corrodibility of the deposits, rates of corrosion of plated foils, loss of weight, increase of permeability and failure of plated coatings, and the effect of certain polysulfonates on the permeability and corrodibility of plated nickel foils. Copies are \$1.00 each.

PLATERS RESEARCH
Control Systems
FOR THE ANALYSES
OF PLATING SOLUTIONS

Years of experience by the chemists of one of the leading consulting laboratories in the field of electro-plating has demonstrated time and again the value of Platers Research Control Systems.

also

STANDARD
ANALYTICAL
REAGENTS

For platers who prefer them, reagents to any normality or specification, indicators and rare chemicals.

PLATERS RESEARCH CORPORATION
59 EAST 4th STREET NEW YORK 3, N. Y.

pH PAPERS

Accurate — Convenient

— Time-saving

instantaneous pH check
right at the tank.

Plating ranges (200 strips per box)

Acid:	Alkaline:
*4.8-6.2	6.6- 8.1
*3.6-5.0	8.2- 9.7
*2.4-3.9	8.8-11.3
1.0-2.8	11.0-13.1
0.4-1.4	

*Electrometric Values in Nickel Solutions.

Each range is boxed separately.

PAUL FRANK

118 East 28th Street NEW YORK 16
Tel. MU 9-5286

RECLAIM YOUR NICKEL ANODES

Why sell your used nickel anodes for scrap? We will reclaim your own anode scrap and convert it into cast oval nickel anodes maximum 36" in length, at a nominal charge. This gives you a considerable saving over the purchase of new nickel anodes, and assures you of a constant supply of anodes.

WRITE FOR COMPLETE INFORMATION

NEW JERSEY METALS COMPANY
712 ROCKEFELLER ST.,
ELIZABETH 2, N. J.

PROFITS?
Increase them with
ELECTROPLATING KNOW HOW!
Details FREE. Write
JOSEPH B. KUSHNER
ELECTROPLATING SCHOOL,
Stroudsburg 99, Pa.

INDIAN BRAND TURKISH EMERY

This old time famous brand of emery is now in stock. Many have been waiting for it. Also available are POLISHING ABRASIVE —best for finest finishing and AMERICAN EMERY—most economical.

HAMILTON

EMERY & CORUNDUM COMPANY
Chester Mass.

Zialite

Reg. U. S. Pat. Off.

FOR HARD CHROMIUM

USE

Zialite

ADDITION AGENTS

Harder deposits.
Increased throwing power.
Less sensitivity to sulfate content.
Exceptionally fine results plating anything calling for Decorative or HARD CHROME.

FOR NICKEL PLATING

The one bath especially designed for plating DIRECTLY on ZINC, LEAD, and ALUMINUM; Brass, Copper, and IRON.
ZIALITE CORPORATION

92 Grove Street Worcester 5, Mass.

ADVERTISING RATES	
Per column inch per insertion	
1 time	\$7.50
3 times	7.00
6 times	6.50
Yearly (12 times)	6.00

READY-REFERENCE SECTION

—USED EQUIPMENT AND SUPPLIES—

ELECTROPLATING
POLISHING
RUST PROOFING
CLEANING
ANODIC TREATMENT
ETC.

FOR SALE

AVAILABLE FOR IMMEDIATE SHIPMENT

PLATING MOTOR GENERATOR SET (REBUILT) WITH COMPLETE PANEL EQUIPMENT—MOTORS—3 phase, 60 cycle, 220/440 volt SYNCHRONOUS.

- 1—CHANDEYSSON ELECTRIC, 1000/500 ampere, 6/12 volt, 900 RPM. Exciter in head, 40 Deg. C. Serial No. 28874.
- 1—CHANDEYSSON ELECTRIC, 750/375 ampere, 12/24 volt, 720 RPM. Exciter in head, 25 Deg. C. Serial No. 29192.
- 1—CHANDEYSSON ELECTRIC, 1500/750 ampere, 12/24 volt, 720 RPM. Exciter in head, 40 Deg. C. Serial No. 30350.
- 1—CHANDEYSSON ELECTRIC, 4000/2000 ampere, 6/12 volt, 450 RPM. Exciter in head, 25 Deg. C. Serial No. 29022.
- 1—HANSON-VAN WINKLE-MUNNING, 4000/2000 ampere, 6/12 volt, 600 RPM. Exciter in head, 40 Deg. C. Serial No. 9635.

- 1—ELECTRIC PRODUCTS, 5000/2500 ampere, 12/24 volt, 600 RPM. Exciter in head, 40 Deg. C. Serial No. 19987.

FOLLOWING SETS—SYNCHRONOUS—3 phase, 25 CYCLE, 220/440 volts—COMPLETE.

- 1—ELECTRIC PRODUCTS, 1500/750 ampere, 6/12 volt, 500 RPM. Exciter in head, 25 Deg. C. Serial No. 21295.
- 1—CHANDEYSSON ELECTRIC, 3000/1500 ampere, 6/12 volt, 375 RPM. Exciter in head, 40 Deg. C. Serial No. 26174.

SACRIFICE FOLLOWING PLATERS, INDUCTION MOTOR DRIVE, WITH COMPLETE PANEL EQUIPMENT—3 phase, 60 cycle, 220/440 volt.

- 1—BENNETT & O'CONNELL "Excel-All," 3000 ampere, 8 volt, double commutator, 775 RPM. M. G. Exciter, 40 Deg. C. Serial No. 5038.
- 1—A. P. MUNNING "OPTIMUS," 5000/2500 ampere, 6/12 volt, 490 RPM. M. G. Exciter, 40 Deg. C. Serial No. 6296.
- 1—BOGUE ELECTRIC, 5000/2500 ampere, 6/12 volt, 575 RPM. M. G. Exciter, 40 Deg. C. Serial No. 725.

PLATERS' BARRELS (REBUILT) Motor Drive—3 phase, 60 cycle, 220/440 volt.

10—Mechanical "Horizontal Type" Single and Double barrel units—new and used. Terrific assortment of Belke and Crown.

- 5—UDYLITE "Utility" Platers.
- 14—CROWN-BAIRD-LASALCO — Size No. 1 and No. 2—Ball-Burnishers.
- 6—BAIRD-GLOBE "Oblique" Tumblers.

POLISHING LATHES—NEW AND USED—CONSTANT AND VARIABLE SPEED—

3 phase, 60 cycle, 220/440 volts—1 to 20 H.P.

RECTIFIERS—General Electric — Mallory Udyllite—SELENIUM—50 to 6000 ampere sizes, 6/12 volt, with regulators, 3 phase, 60 cycle, 220/440 volt.

ALSO—AVAILABLE—OTHER NEW AND USED—GENERATOR SETS AND RECTIFIERS—ranging in size from 50 ampere to 10,000 ampere.

WE CARRY A COMPLETE LINE OF NEW AND USED PLATING AND POLISHING EQUIPMENT AND SUPPLIES.

CLINTON SUPPLY COMPANY

112 South Clinton Street
Chicago 6, Illinois

FOR SALE

Slightly Used
BUFFS

Loose and Sewed

Any Quantity

MICHIGAN BUFF CO., INC.
3503 GAYLORD AVE.
DETROIT (12) MICHIGAN

WANTED

Semi-Automatic Plating Machine.
State Price, Description, Availability.

R. A. PAULSEN
1020 Pleasant St. Oak Park, Ill.

PLATERS AND RECTIFIERS

Amps	Volts	Spd.	Make	Motor
60	5	1800	Acme (vert.)	110-3/80
100	7 1/2	1800	Habart	110/250/60
1000	3/50	900	H. & V. W.	220-3/60 syn.
1000	6	1200	Bogue	220/440-3/60
1000/500	6/12	900	Elec. Prod	220/440-3/60
1500/750	6/12	600	Chaneysson	220-3/60
1000	6	1200	H. Van Winkle	220-3/60
1500/750	6/12	900	El. Prod.	440-3/80
2000/1000	6/12	675	H. Van Winkle	220-3/60
3000/1500	6/12	720	Weaker	220-3/60
3000/1500	12/25	600	H. & V. W.	220-3/60
5000/2500	6/12	490	Munning	

RECTIFIERS

1000	6	Selestro	485/3/60
2000	6	Sel Selestro	485/3/60

THE MOTOR REPAIR & MFG. CO.
1555 HAMILTON AVE., CLEVELAND 14, O.

FOR SALE

Available for Immediate Delivery

REBUILT AND GUARANTEED
EQUIPMENT FOR

- POLISHING • ELECTROPLATING
- SPRAYING • METAL FINISHING

Motor Generator Sets, Rectifiers, Wood, Steel, Lead Lined and Rubber Lined Tanks, Steam Boilers, Rheostats, Polishing, Buffing and Grinding Machines and everything needed for a modern metal finishing department.

H & S

EQUIPMENT & SALES CO.
278 So. 9th St. at B'way—Brooklyn 11, N. Y.
EVergreen 7-3317

AVAILABLE FOR IMMEDIATE SHIPMENT — ATTRACTIVE VALUES

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

- 1—10,000/5000 Ampere, 6/12 Volt, Hanson-Van Winkle-Munning Co. Separately Excited. Synchronous Motor. Excellent Condition.
- 1—6000 Ampere, 2-6 Volt, Jantz and Leist. Separately Excited. Excellent Condition.
- 1—5000/2500 Ampere, 6/12 Volt, Eager Electric Co. Separately Excited. Excellent Condition.
- 1—3000/1500 Ampere, 12/24 Volt, Hanson-Van Winkle-Munning Co. Synchronous Motor. Exciter-In-Head. Excellent Condition.
- 1—2000/1000 Ampere, 6/12 Volt, A. P. Munning "Optimus." Excellent Condition.
- 1—1500/750 Ampere, 6/12 Volt, Hanson-Van Winkle. Excellent Condition.
- 1—1250 Ampere, 15 Volt, Columbia Electric Co. Separately Excited. Ball Bearing Design. Practically New.
- 1—1000/500 Ampere, 6/12 Volt, Electric Products Co. Separately Excited. Excellent Condition.
- 2—1000/500 Ampere, 6/12 Volt, Charles J. Bogue. Separately Excited. Interpole Design. Exciter-In-Head.
- 1—1500 Ampere, 40 Volt, Hanson-Van Winkle-Munning Co. Anodizing Unit. Complete Controls. Synchronous Motor. Excellent Condition.
- 1—1000 Ampere, 40 Volt, Hanson-Van Winkle-Munning Co. Anodizing Unit. Synchronous Motor Drive. Full Controls. Excellent Condition.
- 1—1000 Ampere, 40 Volt, Chaneysson Electric Co. Anodizing Unit. Synchronous Motor Drive. Excellent Condition.
- 1—400 Ampere, 40 Volt "M.G.C." Anodizing Motor Generator Set, Exciter-In-Head.
- 1—1000 Ampere, 25 Volt Hanson-Van Winkle-Munning Co. Anodizing Unit. Separately Excited.
- 5—GREEN SELECTROPLATERS, 1800 Amperes, 12 Volts, for operation on 220 volt, 3 phase, 60 cycle.
- 4—General Electric Copper Oxide Rectifiers, 500 Amperes, 6 Volts, for operation on 220 volt, 3 phase, 60 cycle.
- 1—Green Selectroplaters, 500 Amperes, 6 Volts, for operation on 220 volt, 3 phase, 60 cycle, practically new.

— SPECIAL —

- 1—12,000/6000 Ampere, 12/24 Volt, Brand New Columbia. Separately Excited. Synchronous Motor. Complete Controls.

Priced Right — Immediate Shipment

M. E. BAKER COMPANY
25 WHEELER ST., CAMBRIDGE, MASS.
KIRKLAND 7-5460